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SARGENT'S STUDIES OF THE FORESTS OF JAPAN.

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Within a few years we have had a most valuable contribution to our knowledge of the forest trees of Japan from the hand of Professor Charles S. Sargent, who first published a series of papers in *Garden and Forest*, now collected into a volume entitled the "Forest Flora of Japan." Some of the results of these studies are so at variance with the common statements in papers and books on the geographical distribution of plants as to be quite startling. Thus it is shown that many of the trees usually regarded as Japanese are not actually natives of the islands, but have been introduced from China and other adjacent regions. In discussing this point, reference is made to Dr. Gray's paper on "Forest Geography and Archæology," in which it was shown that Japan is remarkable for the number of species of its forest trees (one hundred and sixty-eight).

"In the Japanese enumeration were included, however, a number of trees which are not indigenous to Japan, but which, as we know, were long ago brought into the Empire from China and Corea, like most of the plants cultivated by the

Japanese. Early European travellers in Japan, like Thunberg and Siebold, who were unable to penetrate far into the interior, finding a number of plants common in cultivation, naturally believed them to be indigenous, and several Chinese plants were first described from individuals cultivated in Japanese gardens. Later writers on the Japanese flora have generally followed the example of the early travellers, and included these plants in the flora of Japan. Indeed, it is only very recently that it has been possible to travel freely in all parts of the Empire, and to study satisfactorily the character and distribution of its flora."

"The list of Chinese and Corean trees cultivated in Japan, and usually enumerated in floras of the Empire, includes *Magnolia conspicua, Magnolia parviflora, Magnolia watsonii, Sterculia platanifolia, Cedrela sinensis, Zizyphus vulgaris, Koelreuteria paniculata, Sapindus mukorosi, Acer trifidum, Rhus vernicifera, Sophora japonica, Liquidambar formosana* (*maximowiczii*), *Cornus officinalis, Diospyros kaki,* and probably *Diospyros lotus, Chionanthus retusa, Paulownia imperialis, Catalpa ovata, Lindera strychnifolia, Ulmus parvifolia, Thuya orientalis, Gingko biloba, Podocarpus nageia, Podocarpus macrophylla* and *Pinus koraiensis.*"

In comparing the forests of Japan with those of other countries, after deducting the foregoing, it is still found that "the Japanese region for its area is unsurpassed in the number of trees which inhabit its forests." Comparing the Japanese forests with those of eastern North America, there are 139 species in 53 genera in the former, and 155 species in 66 genera in the latter. If now we take larger areas in each region, the comparison is equally instructive.

"In eastern North America, that is, in the whole region north of Mexico and east of the treeless plateau of the centre of the Continent, but exclusive of south Florida, 225 species of trees, divided among 134 genera, are now known. The Japan-Manchurian region includes eastern Manchuria, the Kurile Islands, Saghalin, and the four great Japanese islands, but, for our purpose, does not include the Loochoo group, which, although it forms a part of the Japanese Empire politically, is

tropical and subtropical in the character of its vegetation, which, moreover, is still imperfectly understood. In this narrow eastern border of Asia, there are now known 241 trees, divided among 99 genera. The extra Japanese portion of the region contributes but little to the enumeration. In Saghalin, Fr. Schmidt found only three trees which do not inhabit Yezo, and in Manchuria, according to Maximowicz and Schmidt, there are only eighteen trees which do not also occur in Saghalin or the northern Japanese islands. In the four islands of Yezo, Hondo, Shikoku, and Kyūshū, therefore, we now find 220 trees divided among ninety-nine genera, or only five less than occur in the immense territory which extends from Labrador to the Rio Grande, and from the shores of the Atlantic to the eastern base of the Rocky Mountains. Neither *Cycas revoluta* nor *Trachycarpus* (*Chamaerops*) *excelsa* is included in the Japanese list, as the best observers appear to agree in thinking that these two familiar plants are not indigenous to Japan proper. I have omitted, moreover, a few doubtful species from the Japan enumeration, like *Fagus japonica* Maximowicz and *Abies umbellata* Mayr, of which I could learn nothing in Japan, so that it is more probable that the number of Japanese trees will be increased than that any addition will be made to the silva of eastern America."

That the moist and equable climate of Japan is favorable to the growth of woody plants, is shown by the fact that very nearly ten per cent. of the species of Anthophytes and Pteridophytes are trees. If we consider the shrubs also, the proportion of ligneous species is still more remarkable, being almost exactly twenty-two per cent.

"The aggregation of arborescent species in Japan is, however, the most striking feature in the silva of that country. This is most noticeable in Yezo, where probably more species of trees are growing naturally in a small area than in any other one place outside the tropics, with the exception of the lower basin of the Ohio River, where, on a few acres in southern Indiana, Professor Robert Ridgway has counted no less than seventy-five arborescent species in thirty-six genera. Near Sapporo, the capital of the island, in ascending a hill which

rises only 500 feet above the level of the ocean, I noticed forty-six species and varieties of trees. Within five miles of this hill also grow sixty-two species and varieties, or more than a quarter of all the trees of the Empire, which are crowded into an area a few miles square, in the latitude of northern New England, in which, north of Cape Cod, there are only about the same number of trees."

Upon the question of the similarity of the flora of Japan to that of eastern North America, Professor Sargent makes a full discussion, and it is not too much to say that it will compel a change in some of the prevalent notions as to the vegetation of these regions.

"Travellers in Japan have often insisted on the resemblance between that country and eastern America in the general features of vegetation. But, with the exception of Yezo, which is still mostly uninhabited and in a state of nature, and those portions of the other islands which are over 5,000 feet above the level of the ocean, it is difficult to form a sufficiently accurate idea of the general appearance of the original forest-covering of Japan to be able to compare the aspects of its vegetation with those of any other country, for every foot of the lowlands and mountain valleys of the three southern islands has been cultivated for centuries. And the foothills and low mountains which were once clothed with forests, and could be again, are now covered with coarse herbage, principally Eulalia, and are destitute of trees, except such as have sprung up in sheltered ravines, and have succeeded in escaping the fires which are set every year to burn off the dry grasses. Remoteness, bad roads, and the impossibility of bringing down their timber into the valleys, have saved the mountain forests of Japan, which may still be seen, especially between 5,000 and 8,000 feet above the level of the sea, in their natural condition. But these elevated forests are composed of comparatively few species, and if it were not for the plantations of conifers, which the Japanese for at least twelve centuries, it is said, have been making to supply their workers in wood with material, and for the trees preserved or planted in the temple grounds in the neighborhood of towns, it would be impossible to obtain any

idea at all of many of the Japanese trees. But, fortunately, for nearly two thousand years the priests of Buddha have planted and replanted trees about their temples, which are often surrounded by what now appear to be natural woods, as no tree is ever cut and no attempt is made to clear up the undergrowth. These groves are sometimes of considerable extent, and contain noble trees, Japanese and Chinese, which give some idea of what the inhabitants of the forests of Japan were before the land was cleared for agriculture.

The floras of Japan and eastern America have, it is true, some curious features in common, and the presence in the two regions of certain types not found elsewhere shows their relationship. But these plants are usually small, and are rare or grow only on the high mountains. Diphylleia, Buckleya, Epigaea, and Shortia show the common origin of the two floras; but these are rare plants in Japan, as they are in America, with the exception of Epigaea, and probably not one traveller in ten thousand has ever seen them, while the chief elements of the forest flora of northern Japan, the only part of the Empire where, as has already been said, comparison is possible—those which all travellers notice—do not recall America so much, perhaps, as they do Siberia and Europe."

On making a close comparison of the forests of Japan and eastern North America, it is found that in the former region there is no Black Oak, Chestnut Oak, Tulip-tree, Pawpaw, Gordonia, Plum-tree, Locust, Gymnocladus, Liquidambar, Tupelo, Osage Orange, Sassafrass, Plane-tree or Hickory. Moreover, in many instances where a genus has representatives in both regions, the species are rather of the European than the North American type. The Japanese forests contain species of many genera which have no North American representatives, as Euptelea, Cercidiphyllum, Trochodendron, Idesia, Ternstroemia, Cleyera, Eurya, Camellia, Phellodendron, Hovenia, Euscaphis, Maackia, Albizzia, Distylium, Acanthopanax, Syringa, Cinnamomum, Machilus, Actinodaphne, etc., etc. Magnolia and Aesculus occur in both regions, as also Rhus, Hamamelis, Aralia, Cornus, Juglans, Thuya, Chamæcyparis, Picea, Abies and Tumion (*Torreya*).

Other interesting comparisons are made by Professor Sargent showing that in other ways the forests of the two regions are quite unlike, as in the greater number of broad-leaved evergreen trees and shrubs in Japan, the small number of pines, and more striking still, the dense bamboo undergrowth which covers the forest floor, even on the mountains and in the extreme north.

Of the studies of the families of forest trees taken up by the author, it is impossible here to give more than a brief outline, and the reader must be referred to the work itself for the details. Of the Magnolia family there are, in Japan, five genera, while in the United States there are but four; nor are there any evergreen species of the genus Magnolia, resembling those of our southern States. In this family the most important tree is the *Cercidiphyllum japonicum*, which is said to be the largest tree in Japan. It is often one hundred feet high, and its usually clustered stems are often eight or ten feet in diameter at their common base.

Of *Ilex latifolia*, one of the eight arboreal species of hollies, Professor Sargent says that it is "probably the handsomest broad-leaved evergreen tree that grows in the forests of Japan, not only on account of its brillant, abundant fruit, but also on account of the size and character of its foliage." We are told that it will certainly succeed in our southern States, and may be hardy as far north as Washington.

There are twenty species of Japanese Maples, more than twice as many as occur in North America. Two of these belong to the section Negundo. In marked contrast to the Maple family is the Pea family, represented by but three arborescent species, viz.: *Albizzia julibrissin*, *Maackia amurensis* and *Gleditschia japonica;* the latter closely resembles our Honey Locust, even to the appearance of the branches, which are "horribly armed with flattened spines, two or three inches in length." *Fraxinus manchurica*, the Japanese Ash, attains a height of one hundred feet, with a diameter of from three to four feet. It has been grown for many years in the Arnold Arboretum, where it is quite hardy. The Japanese Elms are of minor importance, the principal species being identical with

the Elm of Europe (*Ulmus campestris*), although of much smaller growth. Related to the Elm is the Zelkova, "perhaps the largest deciduous-leaved tree of Japan," as well as "its most valuable timber tree." It attains a height of one hundred feet, and a diameter of eight to ten feet. The best known of the Japanese Oaks is *Quercus dentata*, a tall but irregular tree, "remarkable for the great size of its leaves, which are often a foot long and eight inches broad." *Quercus crispula* and *Quercus grosseserrata* are excellent timber trees, eighty to a hundred feet in height, with a diameter of three to four feet. The Chestnut and Beech are identical specifically with the European trees, but show varietal differences, the former being a more precocious tree, often bearing fruit when but ten or twelve feet in height. Professor Sargent suggests this tree for introduction into the northern United States.

Japan is richer than eastern North America in conifers, and they "are more planted for shade and ornament than they are in America, or, perhaps, in any other country." The great number of Japanese conifers prevents more than a mere mention in this paper of the most important species. *Chamæcyparis obtusa* and *Cryptomeria japonica* are largely planted as timber trees, the former also being one of the sacred trees planted about the temples. *Cephalotaxus drupacea* and *Ginkgo biloba* are common, although it is now agreed that the latter is not a native of Japan, where, however, it grows to a great height (100 feet) in the groves about the Buddhist temples. *Tumion* (*Torreya*) *nuciferum* is the "largest and most beautiful representative" of a curious genus. The Umbrella Pine—*Sciadopitys verticillata*—well-known to us as a small tree in cultivation, is, in its native region, a tall pyramidal tree a hundred feet or so in height. But two pines, *Pinus densiflora* and *Pinus thunbergii* are valuable timber trees. There are also important species of Picea, Tsuga, Abies and Larix, some of which have long been in cultivation in America and Europe.

In closing his interesting account of the Japanese forests, Professor Sargent remarks upon their lack of economic or scientific management, and the imperative need of adopting an intelligent system of reforesting and cultivation. It ap-

pears, however, that "the forests of Yezo are still intact, except where here and there a struggling settlement has broken into the forest blanket which covers this noble island. Here are great supplies of oak and ash of the best quality, of cercidiphyllum, walnut, fir, acanthopanax, cherry and birch—a storehouse of forest wealth, which, if properly managed, could be drawn upon for all time, and which, if the timber is not needed in Japan, may become, when the trans-Asiatic railroad is finished, an important factor in the development of southern Siberia and some of the treeless countries of central Asia."

THE BIRDS OF NEW GUINEA. (MISCELLANEOUS).

By G. S. Mead.

In considering the birds of the tropics or of any portion of the tropics, one is apt to suppose that the birds which are seen therein at any time may be seen at all times. In other words that they are as much fixtures as the trees, that they never migrate. While this may be true of a large number of species, it is not by any means true of every species, even of land birds.

Our own birds are with us a few months only; most of them at the approach of winter go south where, in tropical lands or in low temperate latitudes, they may be found during a longer period. The mere migrants—those that pause on their way north or south for days only—are not taken into account.

It is well then to bear in mind two facts: First, that in every country migratory birds whose period of stay covers a large proportion of the year, are to be met with besides permanent residents; second, that all birds found by travellers are not necessarily permanent residents, but in many instances transient vistors only.

Birds of Paradise are said to move from one island of the Papuan Archipelago to another, in order to avoid storms or stress of weather at certain times of the year. The Nicobar

pigeon also, a heavy flyer, has been seen many miles distant from the mainland.

Probably therefore, in New Guinea, although we find a very large resident population, we also discover many birds that have come from Australia or the Asian Continent to remain but a partial period. Mr. Jukes illustrates this view in his valuable narrative "The Voyage of the Fly."

"While we were in this neighborhood (in Torres Straits, Turtle-back Island) about the end of February, (1845), great flocks of the bee-eater which is common in Australia (*Merops ornatus*) were continually passing to the northward. The white pigeons also (*Caropophaga luctuosa*) were going in the same direction in numerous small flocks, and in March all the pigeons left in the islands were young ones. The bee-eaters go as far to the southward as Sydney during the summer of New South Wales, but we never saw the white pigeons much to the southward of Torres Straits. In September, 1844, they were coming thickly from the northward to Endeavour Strait, and they seem to return in March. What can be the reason of the migration? In these latitudes it is evident that mere temperature cannot be the cause of it, although the variation of the seasons for different fruits or insects may. I had afterwards strong reasons for suspecting, that even on the opposite sides of so small a space as Torres Strait, not more than 120 miles, the seasons are totally different; that the wet season prevails in New Guinea between March and October, which on the north of Australia is the driest part of the year; while from October to March, when most rain falls in Australia, it is probable that the south coast of New Guinea has its driest weather."—J. B. Jukes' Voyage of the Fly, Vol. I, p. 157.

Rich as the entire archipelago is in bird life, many as are the species peculiar to this or that island and found no where else, it would nevertheless be an unjust limitation to enumerate only such forms as are confined to the one region and cannot without the compulsion of some extraneous force pass beyond the barriers of their island home, to the total exclusion of the many additional species of birds that while they may not in all cases breed, yet linger for a longer or shorter period

in the places of their choosing. A large number of species of swallows, king-fishers, raptorial birds, range so widely as to make it impossible to say that they really belong to one island or group of islands rather than to another. In some instances, therefore, we find an interchange of habitat.

The pigeons form a very large chapter in the Natural History of New Guinea. They are many in number and species, (more than 80 are known) of all sizes and characteristics, and are found pretty generally throughout the vast island. Many of the kinds distributed in different quarters in Australia are to be seen in Papua, while several are peculiar to the latter and never found in Australia at all. Almost all phases of columbar development, therefore, may be studied in this region, which ornithologically speaking, is, as has been shown in divers instances, singularly favored. Foremost among the pigeons is the splendid *Goura coronata*, whose stately form is now not uncommon in zoological gardens. It is very large for a pigeon, as large oftentimes as the domestic turkey, very slow in its movements and quiet in its disposition. Its lovely dark blue plumage and the peculiar but beautiful crown, are its chief claims to renown among the many other wonders of its habitat, while its great size distinguishes it among its own kind. The crest is certainly very remarkable, imparting to its wearer a look that no other species of its tribe, indeed no other bird, possesses. It has the appearance of a bunch of long, delicate leaves from which all the pulpy matter has been removed. There appears to be rather individual than specific differences in the crests. The crest of *Goura victoriae* may be thicker towards the top, the thin feathers spreading out into little fans, but this appearance is not invariable. On the other hand *Goura albertisi* boasts a crest fully as large and tall, but the spatulas instead of flowering out as it were, remain of an even texture throughout their length. Yet in this case also, the distinction is not certain. A surer mark of difference between the two species is the white on the wings, this color being particularly noticeable in the *albertisi*.

A dark gray-blue is the dominating color; this becomes paler on the tail, and finally makes a bluish-white band. Whitish

marks appear on some of the feathers, while on the shoulders a fine maroon is visible and again on the under parts. The total length of the bird is fully two and a half feet.

Another species, *Goura sclaterii*, says D'Albertis "is like the crested Goura, but differs from it in having an ashen colored instead of an iron-gray black." Wallace mentions still another species, *Goura steursii* from Jobie, brought from there by the naturalist Rosenberg.

The genus *Eutrygon* of New Guinea is represented by a single species namely, *E. terrestris*. This pigeon is a handsome dark leaden-gray bird with a whitish spot on the forehead. The wings, tail, back and rump are a shining light olive, the sides and under tail coverts rufous. A white collar encircles the neck and throat; bill small and bony. The smallest of the genus *Ptilopus*, *Ptilopus nanus*, is clothed in bronzy-green, set off by a strip of gray on either side the neck, by a patch of purple in the very middle of the abdomen, and yellow touches on the wing coverts. Tail deep green; bright corn-yellow on under tail coverts. Female has no purple spot. The Tiny fruit pigeon it is called.

Another pretty little pigeon is *Ptilopus iozonus*, purple-banded; this dainty miniature of its family is about 8 inches in length. The general color is green, becoming black along the extremities of the long wings. The tail beneath is yellow, buff and white; legs yellow.

The *Chalcophaps margaritae* (*Philogoenas jobiensis*) or white-chested pigeon strikes one at first as being brown or bronze in color, but further observation will show a greater variety of tint. Moreover, as with almost all pigeons, the fundamental color is rich with its reflected lights. The tail is black intermixed with blue, the head black and gray, the neck, breast and throat white. Elsewhere violet, blue, even pink are reflected from the uniform metallic brown surface. This pigeon is small in size, timid and suspicious, and keeps to the ground, rarely perching upon trees.

A fine, large bird, nearly two feet in length, is *Macropygia reinwardtii*, widely distributed over the archipelago. The under parts including the neck and head are pure white or

ashy. Above, over the back, wings and two middle feathers of the long and shapely tail, the color is a warm chestnut. Black occurs also on the primaries, and in lines and edgings along some of the tail feathers, mixed with gray. The feet are red; around the eye runs a circlet of bare skin.

Otidiphaps nobilis, a ground pigeon, is rich in color. On the long feathers of the head a dark green lies; around the neck runs a collar of green rippling with light. A rich brown darkens the metallic surface of the back, while the wings are coffee colored. The curiously rounded tail is a dark blue-black and contains twenty feathers. The note of this bird is strenuous and persistent, lacking perhaps, the volume of certain species, but making up the deficiency by iteration and reiteration. The bill is like a small bone.

To D'Albertis we are indebted for a brief description of *Gymnophaps albertisii, novum genus et nova species.* "The form of their beaks, the nostrils surrounded by a circle of the brightest scarlet, and a large bare space around the eyes of the same brilliant color, give these birds a most curious appearance. The back is generally ash colored, speckled with black at the ends of the feathers."

Among pigeons, indeed among all the feathered folk, there are few more curious looking birds than the species *Caloenas nicobarica*, Nicobar pigeon, representing a genus by itself, scattered more or less abundantly throughout the Malayan Archipelago. It possesses considerable power of flight, although not an easy bird upon the wing, hence its general diffusion over the numberless islands of the Australasian seas. Mr. Guppy records its appearance in the Solomon Islands. The anomalous feature causing the peculiar appearance is the spread of long individualized feathers over the neck, shoulders and back. Thus is formed a kind of disparted mantle in which the lanceolate plumes seem to have been thrust after the subjacent layer was grown. The reflections from this singular covering are a blending of bronze and green. A still brighter reflection is turned from the metallic surface of the wings, a livelier green here meeting the eye. One notices with some surprise, as if it were an incongruous appearance, that the

terminations of the tail feathers are a pure white. Everywhere else we find a uniformity of bronzy coloring, intense indeed with reflections, but without contrasts.

Many of these pigeons, especially of the crowned species, are most delicious eating. The flesh surpasses in flavor, richness and other edible qualities that of almost all game birds. According to the taste of some travellers turkeys, ducks, geese, all must hang their heads in the presence of *Goura coronata*.

The *Talegallus* or Brush turkey is frequently seen in New Guinea, his mound being one of the characteristics features of the country. He is a small bird to accomplish such a task as gathering together in a compact mass, material—brush, dirt, leaves, etc.—in sufficient abundance to fill 20 or 30 large carts. No two travellers seem to make the same measurements. In this, which he treads down firm, the eggs are deposited and then left for the incubation the heat of decaying matter is sure to bring about. Several nests are placed in the same mound and do service for successive seasons. It is very much as if one of our barnyard fowls were transported into the depths of the forest, since the general aspect of the domestic hen and the wild bird is almost identical, and the cackling equally serious and obdurate.

The muscular effort necessary to the heaping up of the mounds must of course be very great; most of the work, if not all, is done by means of the foot, which is of large size and terminates a long, stout leg. While the bird stands on one foot, with the other he grasps the materials to be used and thrusts or kicks them back to the place he wishes. In this way the huge nest is gradually formed until it becomes a very respectable hillock in its dimensions, in some instances 20 to 30 feet through and 15 in height; all this is accomplished by birds (several combining together to perform the task) scarcely larger than a barnyard fowl. This Megapode (not using the term in its strict scientific limitation) is not addicted to flight nor are its wings of sufficient strength to keep it long in the air even were the bird disposed to entrust itself to that element Accordingly when disturbed, if it takes to its wings at all, it is with hurried and laborious strokes usually terminating at

some convenient bough not far away, where it stands with outstretched neck somewhat after the manner of our wild turkey, anxious as to the cause of alarm below. It is a shy timid bird, attentive to its own business solely, yet, like all such creatures, frequently carried away by curiosity.

Its enemies are many, for the flesh is sweet and the eggs nutritious. It would seem, therefore, as if for this defenseless, inoffensive creature, Nature would have provided some special protection. So indeed she has, since in the dusky hue, that blends readily with the forest surroundings, the *Talegallus* is furnished with the best possible protective coloring, but Nature oftentimes appears to delight in being capricious or inconsistent; she here gives an invisible cloak but as if to neutralize the gift, she bestows also a loud, dissonant voice that invites everything within hearing to come and see to what it belongs; and, as if this were not enough, the poor creature is obliged by hapless fate to call public attention to the depository in which its treasures are laid, by the vast size of the structure erected for their concealment.

The general color of the birds is a sober brown, unrelieved by any touch of brightness, unless it be in the pale yellow of the legs. The neck of one species is flushed with red, while in another a warm dark gray reaches as far as the abdomen. In some cases a delicate shading of browns produces a pleasing effect on the body and wings. The bill is dark, short and compact.

Four species are known, namely, *Talegallus lathamii* of Australia and New Guinea, *T. jobiensis*, *T. cuvierii* and *T. fuscirostris*. D'Albertis calls the last *nova species*. It would seem as if some or all of these might be domesticated. The first mentioned is a large bird, in shape and size the counterpart of the female turkey, of a uniformly dark brown plumage and long neck denuded of a compact covering of feathers, but having instead a coarse dull-red skin scantily-clothed with short, stiff feathered shafts. The head presents a similar appearance. The tail is long and keel shaped, and like the wings dull of hue. There is a slight interfusion of gray on the under parts, imparting a mottled appearance to the thighs and abdomen.

Yellow brightens the wattles. The female is like her mate but somewhat smaller. The eggs are pure white, laid in a wide circle, and about 3½ inches long.

Talegallus cuvierii is also a very dark brown with yellow legs and feet. It is not nearly so large a bird as the preceding and is better put together. While the larger bird looks not unlike a loosely set, shambling turkey, the smaller might pass for a trim, plump pullet. The sexes present no special differences. The color throughout is a sooty-brown excepting on the abdomen, which is mottled. The back and hinder parts are covered with a thick bed of the softest down, like the feathers a dark brown.

Talegallus fuscirostrii has been assigned a separate species of its own on account of its dark-colored bill.

T. jobiensis from the Island of Jobie is a variation probably differing but slightly from the species enumerated.

In *Dasyptilus pesquetii* we see a bird which must be classed among the parrots, yet one which possesses a curious resemblance in that most distinctive feature of the parrot family, viz., the head, to hawks and eagles; the eye also is small and fierce, and the beak that of a bird of prey. The feathers too, what feathers there are, for the head is almost bare except the occiput, stand out stiffly as at times of anger those on the head of the eagle. But in all other points the parrot is evident enough. The colors are strongly laid in, although few in number. Black of a greenish tinge covers most of the upper parts, from which the red of the wings stands out vividly; a similar tint scarcely less brilliant appears on the thighs, abdomen and rump; a grayish hue is apparent on the breast, combined with pale yellow, giving a peculiar cast to that part of the body. In length, taking in the somewhat long tail, this anomalous member of his tribe, is about twenty inches.

If the parrot just described is something of a nondescript, the Black Cockatoo, *Aterrimus*, is exceptional because of his great size, for he is the largest of his family. He is also the only member of the genus *Microglossus*. He is to be found pretty generally throughout the archipelago and is always in evidence because of his size, color and eccentricity of looks and

conduct. He measures sometimes 32 inches and is entirely black from his absurd head, which is finely crested, to the long, rounded tail. The only relief to this funereal garb is the bright red of the bare cheeks. The bill is extremely powerful and is used with as much dexterity by its proud possessor as if it were not the most awkward looking thing in the world.

A splendid species of the Gardener, splendid by reason of its crest, for in other features it resembles the *Inornata*, is *Amblyornis subalaris* found in the Astrolabe and Horseshoe Mountains, Southeast New Guinea. One noteworthy fact should not be omitted; its cabin boasts of two entrances, for what special purpose, if any, is a matter of surmise. There is considerable olivaceous on the body of this species and bright, fine stripes on the throat. The beautiful erectile fire-orange crest, tall and spreading, grows dark of hue near the crown, and is also shaded here and there along the sides. The bill lacks the size of the other species. The total length of the bird is only about eight inches. The female is like the male with the exception of the crest. She is without this distinguishing ornament, but the uniform dark brown of the back and the mottled brown-yellow below are the same.

The bower of this species is said to surpass that of any other bird in ingenuity and quaintness. The same general design as we have seen in the case of the *Inornata* is followed by the *Subalaris*. Around a central post or tree-stem the construction is reared; at its foot is a bank of moss into which is thrust flower or twig or other ornament. The running or chasing ring encircles the bank, and over all there is erected a sort of roof probably as a shelter and concealment. Surely instinct or sagacity has not further gone than in this little pleasure house built as it were after a plan, out of material as serviceable and durable as the special purposes required. Easily removable, they are at the same time fitted in the entire work so artistically as to give the appearance of solidity to the fabric.

Ten years ago there was discovered in the Horseshoe Mountains, Eastern New Guinea, a fine Paradise bird, regarded as a new species of a new genus and so classified by the distin-

guished German naturalists Drs. Finsch and Meyer, whose personal knowledge of the great island and its feathered population is so widely appreciated. They named the acquisition *Astrarchia stephaniae* after the Crown Princess of Austria. It is like the brilliant *Astrapia nigra* but differs in some particulars so important, especially in the form of the tail, as to justify its relegation to a genus of its own. The general color is black with violet, green, bronze and blue reflections. There are two, if not three bands, athwart the breast, the one glinting out all the reflections, the other just below, less broad, glowing with a coppery refulgence, while a third so evanescent as to scarcely admit of specification, is of a bluish shade. The under parts do not fail from their dark surfaces to send forth gleams of changing colors—green, golden and brown. The tail is black also, upper and under tail coverts blue-black. From the side of the head proceed velvety-black, shining feathers somewhat lengthened; so too are the loose feathers on the neck. The metallic wings—black and glistening—are of a violet-purplish cast. The bill, feet and irides are black. As in the *Astrapia* the exterior upper tail feathers are curved back at their ends and are of a roseate dye, perceptible but elusive. But it is not in the tints but in the arched shape of the tail feathers, that one essential difference between the *Astrapia nigra*—the Paradise Pie—and *Astrarchia* lies. In the first "the tail is regularly graduated," in the second "the graduation is irregular." Again the head of the latter is less profusely plumaged, nor are the feathers of adornment as long as in the allied genus. On the neck the plumes of *Astrarchia* are not free and upturned, but laid close upon the underlying feathers.

THE CLASSIFICATION OF THE LEPIDOPTERA ON LARVAL CHARACTERS.

By Harrison G. Dyar.

Several articles[1] have appeared in the American Naturalist, presenting different views of the classification of the Lepidoptera. Certain studies on the larvæ have tended to show that there are characters of classificatory importance in this immature stage, and it may be interesting to compare the evidence furnished by them with that deduced from the mature structures.

Prof. V. L. Kellogg, accepting the division of the Lepidoptera into the suborders Jugatæ and Frenatæ, finds in the families of the former certain generalized characters in the mouth parts; but the Hepialidæ exhibit an atrophied condition. In the larvæ these conditions are reversed. The Hepialid larvæ present distinctly the characters of classificatory importance, while the leaf-mining Micropterygidæ are considerably atrophied. In the view advocated by Dr. A. S. Packard, the Hepialidæ are placed, not in a separate suborder, but low in the scale, near the Tortricidæ. Therefore, these larvæ will serve as something of a test between the two views advanced. Dr. Packard has discussed the larvæ of the Hepialidæ and quotes their characters as supporting his views, saying that the hairs are arranged in the same way as in normal Tortricid and Tineid larvæ "the four dorsal hairs arising from minute warts arranged in a low or short trapezoid." He has also given figures of several species (Journ. N. Y. Ent. Soc., iii, 70, pls. iii and iv). This article is, however, open to criticism in two essential points. In the first place, the differential characters of the families of Lepidopterous larvæ do not reside in the dorsal warts. By this argument, Hepialus could equally well be proved to be a Noctuid or a Butterfly. In the second place, the figures of Hepialus larvæ do not show all of the

[1] Am. Nat., March, June and August, 1895.

setæ, often not half of them. Probably they had become lost by attrition in the specimens drawn or possibly they were overlooked; but it is evident that any conclusions founded on these figures will require revision. Dr. Packard's figure of the first stage of *Hepialus mustelinus* is drawn in such a position that the lateral setæ do not show. I have, however, received some of these larvæ from Dr. Packard (who has very kindly furnished me with valuable specimens of larvæ which I should not otherwise have seen); I am able, therefore to present a more detailed drawing. (Fig. 1.)

I have shown in other publications[2] the general arrangement of the setæ common to all Tineids, Tortricids and and other Microlepidoptera, and that the higher families, including the Noctuidæ, Sphingidæ and Butterflies are founded on the same type. The arrangement on the two last thoracic segments and on the abdomen is shown in Figure 5. This type includes what I call the subprimary setæ, certain ones common to all the Microlepidoptera and the Noctuids and their allies, but absent in the newly hatched larva and also in the highest families. They are marked by an asterisk in the figure. Now, clearly, if Hepialus belongs where placed in the view advocated by Dr. Packard, that is to say among the lower "Neolepidoptera," it should possess the subprimary setæ in the normal position. If, however, it belongs to a separate suborder, as the Jugatæ in the view supported by Prof. Kellogg, it should not have them, and for this reason: the subprimary setæ are not universal in the Frenatæ, but exist in two of the superfamilies (of my arrangement), not in the three others. Now Hepialus, if of the rank of a suborder. should show the generalized characters of the other suborder without its special acquired characters which might appear in some of the superfamilies. Therefore, the subprimary setæ should be absent, though this argument does not preclude the presence of other different subprimary setæ, or of other primary ones, not present in the Frenatæ.

Figures 1 and 2 show Hepialus in Stage I and mature. The subprimary setæ are absent but on the thorax are a set of

[2] Ann. N. Y. Acad. Sci., viii, 198; Trans. of the Same, xiv, 50, 1894-5.

setæ quite different from those of the Frenatæ marked + in Fig. 2a (mesothoracic segment), and also the primary setæ, which correspond to those of all other Lepidoptera. Thus Hepialus larva is not only a generalized form, but has pursued a line of development different from all Micros and Noctuids, the only larvæ in any way comparable with it in simplicity. With the three higher groups no one has recently thought of allying it, though formerly it was included among the "Bombyces." This evidence seems to me to be best interpreted as supporting the view that Hepialus represents a group of Lepidoptera (Jugatæ) as generalized as the lowest Micros and of subordinal rank.

However, let us see how favorable an interpretation to the other view can be put on the structures of Hepialus larvæ. That is to say, can the setæ be homologized with the Tineidæ? We recognize at once that no Tineid or related family has such a structure. They are remarkably uniform, for, when not degenerate, the arrangement of Figure 5 obtains, gradually modified in the higher forms by the approximation of iv and v on abdomen, then of i and ii also; on thorax ia and ib, iia and iib, iv and v, respectively, approximate. Therefore, Hepialus is neither typical nor does it represent a high development in the normal line. Still, on the abdomen, the fourth primary seta above the spiracle may correspond to the seta in Cossus hereinafter mentioned, but we must suppose this seta in Cossus to be primary; iv is out of line with v, more as in the Noctuina. Of the secondary setæ, the lower may correspond to vi, the upper is unexplained. On the thorax the upper anterior primary seta is unexplained; the two subprimaries may correspond to iii and v but moved up out of all association with iv. Thus by some violent movements we have homologized a part of the subprimary setæ of Hepialus with those of the Tineidæ. It is true that considerable movements may occur; I was deceived by such in my first explanation of the Psychidæ. Granting the possibility then, it could be argued that Hepialus may really belong with the Tineidæ, were it not for the two unexplained setæ; but the whole explanation is too forced to pursue further.

To turn now to the Protolepidoptera (Packard's suborder I). Aside from the generalized condition of the mouth parts and the body as a whole, no characters appear to prove that Eriocephala is entitled to subordinal rank. The possession of generalized characters is also called for in placing this genus in the Jugatæ. It is true that if the external lobe of the maxillæ corresponds to the tongue and not the inner (galea) in Eriocephala as Dr. Packard implies in his article, quoting Dr. Walter, we would have a real difference, indicating a dichotomous division. But Dr. Walter homologizes the true tongue of his "höheren Micropteryginen" (the Paleolepidoptera of Packard), also with the outer lobe, stating "Die Innenlade der Maxille ist indes völlig geschwunden. Als einzige Maxillarlade ziegt sich hier ein zwar noch kurzes, aber typisch entwickeltes und leicht rollbares Rüsselchen" (Jena. zeit. fur Naturwissenschaft, xviii, 761) and Prof. Kellogg thinks that it is the inner lobe in all cases that corresponds to the tongue (Am. Nat., June, 1895, p. 547), finding a rudiment of the outer lobe in the true Micropterygidæ.

The larva of Eriocephala is admittedly a specialized one. Not much is to be gained in discussing it, as it is in the interest of both views to show it different from most larvæ. Still I will show that the arrangement of the setæ may be derived from the Micropteryx type. Their form is unique and most interesting, but not valuable in classification.

I will briefly discuss, but in more detail, the characters of the larvæ of the several families of the Jugatæ, as far as they are known to me.

Suborder JUGATÆ.

Superfamily HEPIALIDES.[3]

Family *Hepialidæ.*

Hepialus mustelinus. Stage I (Fig. 1). The prothoracic segment is normal for all generalized Lepidoptera. On the two posterior thoracic segments the primary setæ are present with

[3] Grote, Syst. Lep. Hildesiæ, 1895.

an additional primary seta (marked + in the diagram Fig. 1c). On the abdomen, the primary setæ are present with a small additional one behind tubercle iii (+ in Fig. 1d). I am indebted to Dr. Packard for the specimen.

Hepialus humuli. Mature larva (Fig. 2). On the prothorax the cervical shield extends down to include the setæ before the spiracle. No setæ added to those in the first stage. On the last two segments the setæ are as in Stage I, without any of the true subprimary setæ (associated with iv and marked * in Fig. 5), but two different ones are present (marked * in Fig. 2a), associated with iib. On the abdomen there are present, besides the primary setæ, two subprimary ones (marked * in Fig. 2b). There are four primary setæ above the spiracle, which is unknown in any other Lepidoptera except in the Microlepidopterous genus Cossus, where the fourth seta is probably secondary (I have not seen Stage I of Cossus) and in the butterfly Danais, where it occupies a different position. The upper subprimary seta is without an analogue so far as I know. The lower one I have formerly interpreted as being the subprimary tubercle vi of the Micros (Ann. N. Y. Acad. Sci., viii, 198), but this was before I had examined considerable material. This interpretation is still possible, but in view of the fact that the tubercle is associated with vii as vi never is, and in view of the condition on the thorax, we cannot regard it as the homologue of vi.

Hepialus lupinulus. Mature larva. The structure is the same. I cite the species to show that the characters described above are generic and not individual. In my example (a blown specimen) a number of the setæ have been lost during the journey from Europe but the tubercles from which they arose can be distinguished plainly under a half inch objective in the proper positions.

Superfamily MICROPTERYGIDES.

Family *Micropterygidæ.*

Micropteryx purpurella. Mature larva (Fig. 3). The rudimentary setæ are difficult to distinguish. On the thorax I

discover but one seta to represent ia and ib; the rest are present, but without any subprimary ones. On the abdomen the primitive arrangement prevails. I take the two lower setæ to represent vii and viii (the latter corresponding to one on the inside of the leg in Hepialus, which could not be shown in the figure) and consequently subprimary vi is absent. There is nothing here to contradict placing this genus with Hepialus in the suborder Jugatæ, but I do not emphasize the point, on account of the extreme reduction of the setæ. Larvæ kindly sent me by Dr. T. A. Chapman.

Family *Eriocephalidæ.*

Eriocephala calthella. Stage I (Fig. 4). Dr. Packard has kindly loaned me a slide of these larvæ prepared and given him by Dr. Chapman. Dr. Chapman has recorded many interesting observations on these larvæ (Trans. Ent. Soc. Lond., 1894, 337–344), but only the arrangement of the setæ concerns us here. Dr. Chapman's dorsal view (l. c. pl. vi, Fig. 1) corresponds with my own observations. His lateral views, however, are on a smaller scale and the lowest row of setæ has been omitted. It was apparently not seen, as it is stated in the text that there are "8 rows of globular appendages" or setæ, that is four on each side, whereas, in reality there are are five rows, The two lower setæ on the prothorax also escaped observation. These corrections should be made to Dr. Chapman's account.

The setæ are highly modified and their arrangement has been much specialized as shown by the fact that the last two thoracic segments are like the abdomen. This is the case in no generalized type and has only been so perfectly attained in some of the highest lines of development in the Frenatæ. Nevertheless, by omitting seta iv on the thorax and iii on the abdomen, the arrangement could easily be derived from that of Micropteryx. I do not wish to suggest that this is the actual homology, for my material is too limited, but there seems nothing to preclude a derivation of Eriocephala from Micropteryx.

The curious abdominal legs are unique in the Lepidoptera. Probably they have been derived secondarily and have no homologues elsewhere. Dr. Chapman has endeavored to ally Eriocephala with the Limacodidæ (Eucleidæ). Certainly there are several curious and striking analogies,[4] but I believe that these families really have no affinity. This is not the place for a discussion of the reasons for this view and I will only remark that the arrangement of the setæ is clearly not homologous.

Explanation of Plate.

Fig. 1. *Hepialus mustelinus*, Stage I, side view. *a*, head and thorax; *b*, one segment of abdomen; *c*, a thoracic segment made diagrammatic and the leg setæ omitted; *d*, an abdominal segment made diagrammatic.

Fig. 2. *Hepialus humuli*, mature, a diagram of the setæ. *a*, thorax; *b*, an abdominal segment.

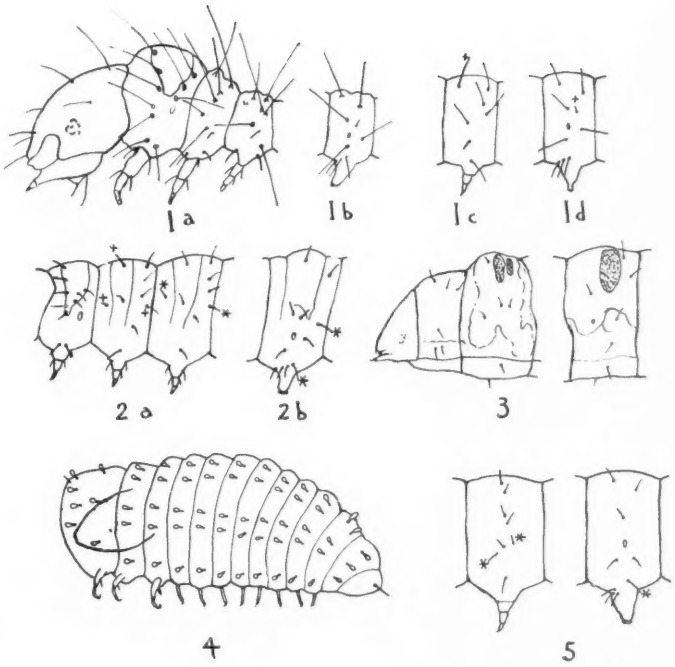
Fig. 3. *Micropteryx purpurella*, mature, first two thoracic and an abdominal segment.

Fig. 4. *Eriocephala calthella*, Stage I. The whole larva is represented, side view, but only the setæ are shown. The head is retracted and its outline appears by transparency.

Fig. 5. A diagram of the metathoracic and abdominal setæ of the primitive Microlepidoptera (Tineides).

[4] These are (1) the retractile head, (2) the angular outline of the body section, ridged subdorsally and laterally and bearing setæ on the ridges, (3) the presence of a series of dorsal and lateral intersegmental areas corresponding in position to to the largest of the depressed spaces of the Eucleidæ, (4) the unusual number of abdominal legs, on the same segments as the suckers of the Eucleidæ, especially in the presence of a foot on joint 5 (first abdominal segment), which bears no appendage in any other Lepidopterous family than these two, and is also apodal in the phytophagic Hymenoptera, (5) the tendency to have the thoracic setæ arranged like the abdominal ones.

PLATE XXXVII.



Dyar on Lepidoptera.

RECENT LITERATURE.

Flora of Denver.[1]—The author of this little book states in her prefaces that "this Flora was written with the sole aim of helping students to learn the names of the plants that grow around Denver." She has accordingly made a simple book, in which, however, she has striven to secure a reasonable amount of scientific accuracy. In this she has succeeded very well. She has descriptions, (sometimes very short, and in sedges and grasses a mere list of names) of about 500 flowering plants, which must prove useful for the young people who study the plants of the vicinity of Denver. We understand that this is a prodrome of a more complete work to appear in the future. In it doubtless the nomenclature will be modernized and characters supplied to the families and genera.—CHARLES E. BESSEY.

Two Plant Catalogues.—In 1868 the Portland Society of Natural History published a Catalogue of the plants of Maine, which has been a standard list for a quarter of a century. We now have a new Catalogue[2] in which the results of much recent work have been incorporated. In the Catalogue proper issued in 1892 we find 1509 species and varieties of Phanerogams and 69 Pteridophytes. In the supplement these numbers are increased by 149 Phanerogams and 6 Pteridophytes. Seventy-seven names must be dropped from the original list, leaving at present a total of 1656 species and varieties. This is in truth a very good beginning toward the acccomplishment of the final catalogue, of which this is but the forerunner.

The arrangement and nomenclature are ultra-conservative, and this in spite of the fact that the author recognized the propriety of changes in both. Such a course is not scientific, nor do we think it is wise. What defense can be made of this—which we find on p. 42? "While in the case of the class *Gymnorpermæ* it would perhaps have been well to follow the more natural system of placing it between the *Monocotyledoneæ* and the *Pteridophyta*, yet it has been thought better to follow closely the sequence adopted by Gray;" or of this in the next para-

[1] *A Popular Flora of Denver, Colorado*, by Alice Eastwood. San Francisco. Zoe Publishing Company. 1895, 57pp.

[2] *The Portland Catalogue of Maine Plants*, Second edition extracted from the Proceedings of the Portland Society of Natural History, 1892, and *Supplement to the Portland Catalogue of Maine Plants*, extracted from the Proceedings of the Portland Society of Natural History, 1895, by Mr. L. Fernald.

graph? "So also the names in some cases might have been changed with advantage, but it was decided to follow the nomenclature of the 6th edition of Gray's Manual of the Botany of the Northern United States." It used to be the boast of Science that her votaries had the courage of their convictions; let us hope that this may continue.

As a list, however, the catalogue speaks well for the activity of the botanists of Maine. We note in the supplement the unlooked for occurrences of several far-western plants, viz., *Oxytropis lamberti sericea, Glycyrrhiza lepidota, Artemisia biennis, Cenchrus tribuloides.*

In the "Flora of Pasadena,"[3]—In a pamphlet of 45 pages Professor McClatchie has catalogued 1056 plants which he has found upon an area about ten miles north and south and six miles east and west, lying about the city of Pasadena, California. The southern edge of this tract is 500 feet above sea level while the northern edge rises to 5000 or 6000 feet upon the San Gabriel Mountains; at its western edge is a deep cañon traversed by a swift stream, and numerous small streams flow from the interior of the tracts.

Upon this small, but varied region have been found of Protophyta 40 species; Phycophyta, 50; Carpophyta, 350; Bryophyta, 53; Pteridophyta, 21; Spermaphyta, 542. The catalogue is therefore a list of the *plants* of the region, not of "the flowering plants and vascular cryptogams," as is so commonly the case in similar undertakings. Several things about the catalogue are especially commendable; thus, the place of publication of the new species (sixty-two) is given in all cases, a most helpful feature. This sentence, also, is significant, and hopeful; "being opposed to the naming of new species after collectors. I have attempted to prevent any being given my name, and have succeeded in all cases except one." Another commendable feature is that the author has "attempted to follow the Rochester rules for nomenclature." If we compare the two catalogues, we find that both show excellent work as their basis, but the western author is shown to have a broader conception of systematic botany, and to be less trammeled by the traditions of conservatism than the eastern one.—CHARLES E. BESSEY.

Frank's Diseases of Plants.[4]—The first volume the new edition of this useful work has recently appeared from the hand of Dr. Frank,

[3] Flora of Pasadena and Vicinity, by Alfred J. McClatchie. Reprinted from Ried's History of Pasadena. Los Angeles, California, 1895.

[4] *Die Krankheiten der Pflanzen*, Dr. A. B. Frank. Erster Band, Zwiete Auflage, Breslau, Verlag von Edward Trewendt, 1895, pp. 344.

of the Royal Agricultural High School of Berlin. The present volume deals solely with the those "diseases" which are due to inorganic agencies, those due to the attacks of parasitic animals and plants being deferred to the second volume. Thus we have nearly one-half of the book devoted to wounds, somewhat less than a third to atmospheric influences, about a sixth to the influence of the soil, while in remaining pages various other agents are discussed. A few woodcuts help to illustrate the text. An English work of this kind would be useful.—CHARLES E. BESSEY.

Wilson's Atlas of Karyokinesis.[4]—It is the object to this altas to place before students and teachers of biology a practically continuous series of figures photographed directly from nature, to illustrate the the principal phenomena in the fertilization and early development of the animal egg. The new science of cytology has in the course of the past two decades brought forward discoveries relating to the fertilization of the egg and the closely-related subject of cell-division (karyokinesis) that have called forth on the part of Weismann and others some of the most important and suggestive discussions of the post-Darwinian biology. These discoveries must in some measure be dealt with by every modern text-book of morphology or physiology, yet they belong to a region of observation inaccessible to the general reader or student, since it can only be approached by means of a refined histological technique applied to special objects not ordinarily available for practical study or demonstration. A knowledge of the subject must therefore, in most cases, be acquired from text-books in which drawings are made to take the place of the real object. But no drawing, however excellent, can convey an accurate mental picture of the real object. It is extremely difficult for even the most skilful draughtsman to represent in a drawing the exact appearance of protoplasm and the delicate and complicated apparatus of the cell. It is impossible adequately to reproduce the drawing in a black-and-white text-book figure. Every such figure must necessarily be in some measure schematic and embodies a considerable subjective element of interpretation.

The photograph, whatever be its shortcomings (and no photograph can do full justice to nature), at least gives an absolutely faithful representation of what appears under the microscope; it contains no subjective element save that involved in the focussing of the instrument, and hence conveys a true mental picture. The present work, therefore,

[4] An atlas of the Fertilization and Karyokinesis of the ovum. By Edmund B. Wilson, Ph. D., Professor of Invertebrate Zoology in Columbia College, New York. Columbia University Press McMillan & Co., 1895.

serves a useful purpose, especially by enabling teachers of biology to place before their students a series of illustrations whose fidelity is beyond question, and which may serve as a basis for either elementary or advanced work in this direction.

The photographs have been taken from the eggs of the sea-urchin, *Toxopneustes variegatus* Ag. (a classical object for the study of these phenomena), taken as a type. The eggs having been cut into extremely thin sections $\frac{1}{8000}$ to $\frac{1}{5000}$ inch.) were stained in iron-hæmotoxylin, and projected by means of the Zeiss apochromatic oil-immersion objective, 2 mm. focus, at an enlargement varying from 950 to 1000 diameters. They have been reproduced *absolutely without retouching* or modification of any kind.

Following is a partial list of the points clearly shown in the present series:—The ovarian egg, with germinal vesicle, germinal spot and chromatin-network; the polar amphiaster with the "Vierergruppen" or quadruple chromosome-groups; the unfertilized egg, after extrusion of the polar bodies; entrance of the spermatozoon, the entrance-cone; rotation of the sperm-head, origin of the sperm-aster from the middle-piece, growth of the astral rays; conjugation of the germ-nuclei, extension and division of the sperm aster; formation of the cleavage-nucleus; the attraction-spheres in the resting-cell; formation of the cleavage-amphiaster, origin of the spindle-fibres and chromosomes; division of the chromosomes, separation of the daughter-chromosomes; structure and growth of the astrosphere; degeneration of the spindle; formation of the "Zwischenkörper;" origin of the chromatic vesicles from the chromosomes; reconstruction of the daughter-nuclei; cleavage of the ovum; the two-celled stage at several periods showing division of the archoplasm-mass, "attraction-spheres" in the resting-cell, formation of the second cleavage-amphiasters.

The explanatory text comprises a simple introductory account of the general history of the subject (for the use of students and general readers), with a number of figures, mostly original, but a few copied from Boveri. In the descriptive part a more critical description of the photographs is given, with drawings illustrating every stage shown.

The atlas will be of great utility to embryologists and biologists in general, and the execution will satisfy the student, as worthily illustrating the text. The reputation of the author guarantees the accurracy of the work.

A Delightful Book on Butterflies.[5]—In these excursions into

[5] Frail Children of the Air. By Samuel Hubbard Scudder. Houghton, Mifflin & Co., Boston, 1895. Price $1.50.

the world of butterflies, Dr. Scudder has treated of some of the most fascinating phases of biological science in an extremely interesting manner. The comparatively few who had read these essays as they originally appeared in the author's classic Butterflies of New England —a work so expensive that it could only be accessible to a limited number of readers—will rejoice that they are now available to every seeker after biological knowledge. In the thirty-one chapters which the book contains there are discussions of such subjects as these: Butterflies in Disguise; a Study of Mimicry; Deceptive Devices Among Caterpillars; Butterflies as Botanists; Color-relations of Chrysalids to their Surroundings; Butterfly Sounds; Nests made by Caterpillars: The Eggs of Butterflies; The Oldest Butterfly Inhabitants of New England; The Procession of the Seasons; Lethargy of Caterpillars; Fossil Butterflies. Each of these subjects is discussed with the fullness of knowledge and excellence of style which characterize the authors writings. The book is certain of a hearty welcome from lovers of nature-knowledge.—CLARENCE M. WEED.

RECENT BOOKS AND PAMPHLETS.

ABBOTT, W. L.—Notes on the Natural History of Aldabra, Assumption and Glorioso Islands, Indian Ocean. Extr. Proceeds. U. S. Natl. Mus., XVI, 1894. From the Smithsonian Institution.

ALLEN, J. A.—On the Species of the Genus Reithrodontomys. Extr. Bull. Amer. Mus. Nat. Hist., 1895. From the author.

BAILEY, V.—The Pocket Gophers of the United States. Bull. No. 5, U. S. Dept. Agric. Washington, 1895. From the Dept.

BAIN, H. F.—Preglacial Elevation of Iowa. Extr. Proceeds. Iowa Acad. Sci., Vol. II, 1894. From the author.

BALCH, T. W.—Some facts about Alsace and Lorraine. Extr. Bull. Geog. Club of Philada. March, 1895. From the Club.

BARBAZON DU BOCAGE, J. V.—Sur un Batracien nouveau dur Fernando Po. Extr. Jorn. Sci. Math., Phys. e Nat. (2) XII, 1895. From the author.

BEAN, B. A.—Descriptions of two new Flounders, *Gastropsetta frontalis* and *Cyclopsetta chittendenii*. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895. From the author.

BEAN, T. H.—Description of a new species of Fish, *Bteekeria giltii*. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895.

——Description of a new species of Rockfish *Sebasthicthys brevispinis*, from Alaska. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII. From the author.

BEAN, T. H. AND B. A. BEAN.—Description of *Gobioides broussonetii*, a Fish new to North America, from the Gulf of Mexico. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895. From the authors.

Bulletin Nos. 22 and 23, 1895, Wyoming Experiment Station University of Wyoming.

CHAMBERLAIN, T. C.—Recent Glacial Studies in Greenland. Extr. Bull. Geol. Soc. Am., Vol. 6, 1895.——Classification of American Glacial Deposits. Extr. Journ. Geol., Vol. III, 1895. From the author.

CHAPMAN, F. M.—On the Birds of the Island of Trinidad. Extr. Bull. Am. Mus. Nat. Hist., Vol. VI, 1894. From the author.

COCKERELL, T. D. A.—Notes on the Geographical Distribution of Scale Insects. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895. From the Smithsonian Institution.

Commissioner's Report for 1892. U. S. Commission of Fish and Fisheries. Washington, 1894.

DALL, W. H.—Contributions to the Tertiary Fauna of Florida. Pt. III. A new Classification of the Pelecypoda. From the author.

DUMBLE, E. T.—Cretaceous of Western Texas and Coahuila, Mexico. Extr. Bull. Geol. Soc. Am., Vol. 6, 1895. From the author.

FAIRBANKS, H. W.—The Stratigraphy of the California Coast Ranges. Extr. Journ. Geol., Vol. III, 1895. From the author.

GEIKIE, J.—Classification of European Glacial Deposits. Extr. Journ. Geol., Vol. III, 1895. From the author.

GILL, T. N.—On the Nomenclature of the Myliobatidae or Aëtobatidae. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1894.

HEILPRIN, A.—The Progress of Discovery and the Lands of Promise to the Explorer. Extr. Bull. Geog. Club of Phila., Vol. I, No. 3, 1894–95. From the Club.

HERTWIG, O.—The Cell: Outlines of General Anatomy and Physiology. Translated by M. Campbell. New York and London, 1895, Macmillan and Co. From John Wanamaker's.

HILL, R. S.—Notes on the Geology of the Island of Cuba. Extr. Bull. Mus. Comp. Zool. Harvard, Vol. XVI, 1895. From the author.

HOWARD, L. O.—On the Bothriothoracine Insects of the United States. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895. From the author.

LEVERETT, F.—On the Correlation of New York Moraines with raised Beaches of Lake Erie. Extr. Am. Journ. Sci., Vol. L, 1885. From the author.

LONSDALE, E. H.—Cement Materials in Iowa. Extr. Proceeds. Iowa Acad. Sci., 1894, Vol. II.——Upper Carboniferous of southwestern Iowa. Ibid. From the author.

MILLER, W. S.—The Anatomy of the Heart of Cambarus. Extr. Trans. Wisc. Acad. Sci., Arts and Letters, Vol. X, 1895. From the author.

PIERS, H.—On the Nidification of the Winter Wren in Nova Scotia. Extr. Trans. Nova Scotian Inst. Sci. (2) I, 1892. From the author.

POWELL, E. P.—Religion as a Factor in Human Evolution. Chicago, 1895. From the author.

Report for the year 1894–95, presented by the Board of Managers of the Observatory of the Yale University to the President and Fellows.

RICHMOND, C. W.—Diagnosis of a new genus of Trogons (Heterotrogon) based on *Hapaloderma vittatum* of Shelley, with a description of a female of that species. Extr. Proceeds. U. S. Natl. Mus., Vol. XVII, 1895. From the Smithsonian Institution.

RIDGWAY, R.—Remarks on the Avian genus Myiarchus, with special reference to *M. yucatanensis* Lawrence. Extr. Proceeds. U. S. Natl. Mus., Vol. XVI, 1893. From the Smithsonian Institution.

——Ornithology of Illinois. Natural Hist. Surv. Ill., Vol. II, Pt. I, Springfield, 1895. From the Survey.

SHUFELDT, R. W.—Notes on the Trunk Skeleton of a Hybrid Grouse. Extr. The Auk, Vol. X, 1893. From the author.

SMITH, J. P.—Geologic Study of Migration of Marine Invertebrates. Extr. Journ. Geol., Vol. III, 1895. From the author.

STEJNEGER, L.—Remarks on Japanese Quails. Extr. Proceeds. U. S. Natl. Mus., Vol. XVI, 1894. From the Smithsonian Institution.

SWAMI, VIVEKANANDA.—The Religion of the Hindus. Extr. Neely's Hist. Parliament of Religions. Chicago, 1893. From the Pub., F. T. Neely.

TAYLOR, W. E.—Preliminary Notes on the Osteology of the North American Crotalidae. Extr. Am. Nat., 1895. From the author.

TROUESSART, DR.—Sur la Progénèse des Sarcoptides psoriques. Extr. Comptes rendus séances Soc. Biol., 1895.——Description d'un genre nouveau (Labidocarpus) et de deux espèces nouvelles de Sarcoptides pilicoles. Extr. Bull. Soc. Entomol. de France, 1895. From the author.

TUTT, J. W.—Rambles in Alpine Valleys. London, 1895. From the Pub., Swan Sonneuschein & Co.

VANDER VEER, A.—Report on one hundred and forty-five operations done for the removal of ovarian tumors and pathological conditions associated with the ovaries and uterine appendages only. Extr. Am. Journ. Obstetrics, 1895. From the author.

VAUGHN, T. W.—The Stratigraphy of northwestern Lousianna. Extr. Am. Geol., Vol. XV, 1895. From the author.

General Notes.

PETROGRAPHY.[1]

The Lherzolites of the Pyrenees and their Contact Action.—The contact action of the lherzolites of the Pyrenees upon the lower Jurassic rocks through which they cut has been studied carefully by Lacroix,[2] who publishes his conclusions in a volume illustrated

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Comptes Rendus, Feb. 11, 1895. Nouv. Archiv. D'hist. Nat., III, Sér. vi, p. 209.

by six plates containing fifty figures. The intensity of the metamorphism varies widely. At 500 meters from the contact the limestones are filled with metamorphic minerals, and even at 1.5 kilos from the nearest visible contact with the eruptive the limestomes still contain many of these. The altered sedimentary rocks are limestones, calcareous marls and occasionally sandstones. In the limestones the principal new minerals found are dipyr, micas, feldspars, tourmaline, rutile, sphene, magnetite, hematite, pyrite, apatite, quartz, graphite and rarely spinel, epidote and garnet. The calcareous marls have been changed to aggregates of silicates with four types of structure, the honestone, the micaceous schist and the amphibolitic and dioritic. Near the contact the organic coloring matter of the marls has disappeared. A little further away it is changed to graphite and at a greater distance it remains intact. The fissures cutting through the metamorphic rocks are lined with zeolites, which, however, the author does not think are connected in any way with the metamorphic processes. The sandstones, at the only contact seen, were changed into quartzites rich in needles of rutile, and a lusite, sillimanite and a few flakes of mica. A close similarity exists between the contact action of lherzolites and granites. The difference in the two cases consists in a corrosion of the metamorphic rocks by the granite and a great production of feldspar, while in the case of the lherzolites there is no transition between the metamorphosing and the metamorphosed rocks. The conditions determining the nature of the contact rock formed are: 1, the original composition of the sedimentary beds; 2, the quantity of the volatile and soluble substance accompanying the eruptive; and 3, the conditions under which the rock was erupted.

Nepheline Rocks from the Kola Peninsula.—A full account of the nepheline syenite region of the Kola Peninsula, Finland, by Ramsey[3] and Harkman has recently appeared. The main results of the senior author's study of the region have already been given in these notes. Other results can only be referred to, as they are two numerous to be described in detail. The authors define a new rock type—imandrite. It is a rock composed of quartz, plagioclase, chlorite, biotite and several accessory components. The first two minerals occur in isometric grains separated from each other by seams of chlorite or biotite. The rock has a half clastic structure, since the quartz and feldspar appear often as fragments in the interstitial chlorite. The quartz is largely secondary, and is supposed to be due to a silicification

[3] Fennia, 11, No. 2, 1894. Also American Naturalist, 1892, p. 334.

of the original rock. A second type of imandrite resembles a silicified porphyritic rock. A hypersthene-cordierite-hornfels, with handsome cordierite crystals, an oliving-actinolite schist, containing cordierite, and several contact metamorphosed sediments are described in detail. The major portion of the article deals with the nepheline syenites and the related rocks—theralites, augite-porphyrites, iolites, monchiquites, tinguaites, etc., and the new rocks, lujavrite and tawaite. The theralite agrees exactly with Rosenbusch's definition of the type. It is a medium grained aggregate of idiomorphic pyroxene, and granitic plagioclase and nepheline, with the accessories brown hornblende, biotite, sphene, magnetite, apatite, sodalite and secondary zeolites. Lujavrite is a trachytic nepheline-syenite with its components largely idiomorphic. Tawaite is a coarse-grained mixture of sodalite and pyroxene.

Around the periphery of the nepheline syenite the rock is different from its main mass and it has produced contact effects with surrounding rocks. A nepheline syenite with a trachytic structure is described among the peripheral phases of the syenite, and a rock resembling pulaskite, but containing no porphyritic crystals. This rock, which the authors call umptekite, is a nepheline syenite, poor in nepheline. It differs from the nepheline syenite in containing a calcium-feldspar, from augite-syenite in possessing hornblende instead of augite, from laurvikite in its structure, and from akerite in its lack of quartz. Its structure is granitic. Arfvedsonite is its principal amphiboloid, and besides, it possesses aegerine. The characteristic minerals of the nepheline syenite are also present in it. The aegerine is frequently associated with sodalite or with feldspar in pegmatitic intergrowths. A sillimanite gneiss is mentioned as possibly being a metamorphized sediment.

The Matrix of Naxos Corundum.—The corundum[4] of Naxos occurs in an iron gray foliated or massive granular rock composed almost exclusively of corundum and magnetite. The first mentioned mineral is in largest quantity. Associated with these two components are limonitic and hematitic alteration forms of magnetite, margarite, tourmaline, muscovite, cyanite, staurolite, biotite, rutile and occasionally spinel, vesuvianite and pyrite. The corundum is in rounded grains or in well defined crystals surrounded by magnetite. Most of the other constituents, with the exception of the magnetite, appear to be the results of shearing. An analysis of the rock gave: Corundum

[4] Tschermak, Min. u. Petrog. Mitth., xiv, p. 311.

=64.2%; Magnetite=26.8%; Iron oxides=6.9%; Siliceous products =2.00%.

Miscellaneous.—In the abstract of a paper read before the Geological Society of America, E. B. Mathews[5] gives a brief account of several distinct types of granite, covering an area of 900 square miles, in the Pike's Peak district, Colo. All are believed to be portions of a single magma, erupted at different times, with the later portions cutting through the earlier ones.

Bayley[6] records the existence of a series of acid and basic tuffts, amygdaloids, glassy and crystalline lavas, and spherulitic phases of volcanic rocks on North and Vinal Haven, Maine.

Darton and Kemp,[7] in the same brochure describe a dyke near Dewitt centre, three miles east of Syracuse, N. Y. It is a peridotite similar to that described by Williams from Syracuse. Its composition is represented by the following figures:

SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	MnO	Nio	CaO	BaO	SrO	Mgo	K_2O	Na_2O	P_2O_5	CO_2	SO_3	S	H_2O	Total	$-O=S$
36.80	1.26	4.16	.20	8.33	.13	.09	8.63	.12	tr	25.98	2.48	.17	.47	2.95	.06	.95	7.44	=100.22	—.47=99.75

Lepsius[8] divides gneisses into meta-gneisses—those formed by the metamorphism of sedimentary rocks, pro-gneisses—those constituting portions of the original earth crust, gneiss-granites—those produced from granite by fluidal movements of a liquid rock magma—and clasto-gneisses, those formed by the crushing of a solid granite.

Hornung[9] has examined a series of rocks associated with the melaphyres in the South Harz, and has shown that some of those that have been called clay slates are in reality volcanic tuffs. Their material was erupted in two different periods, and both were erupted before the melaphyre. The older tuff is composed essentially of a green basic pumiceous glass, the second of splinters of biotite, zircon, quartz, plagioclase, pyroxene and red garnet. Both have the typical tufaceous structure. The tuffs are interbedded with sediments, and their material is more or less thoroughly intermingled with the material of these latter rocks.

In the District of Columbia granitic rocks[10] have disintegrated into

[5] Bull. Geol. Soc. Amer., Vol. 6, p. 471.
[6] Ib., p. 474.
[7] Ib., p. 477.
[8] Notizbl. des Ver. f. Erdk. iv Folge. 15 Hft., p. 1.
[9] Min. u. Petrog Mitth., xiv, p. 283.
[10] Merrill, Bull. Geol. Soc. Amer., Vol. 6, p. 321.

sandy soils, whose composition is almost identical with that of the compact rock from which they were derived.

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	P_2O_5	Ign	Total
Rock	69.33		14.33		3.60	3.21	2.44	2.70	2.67	.10	1.22	=99.60
Soil	65.69	.31	15.23	4.39		2.63	2.64	2.12	2.00	.05	4.70	=99.76

The disintegration processes are not chemical except in so far as hydration is chemical, but they are mainly mechanical.

Formation of Dolomite.—A most important contribution to the study of the formation of dolomite is made by M. C. Klement in the Bull. Soc. Belge Géol. Paléontol. et Hydrol. After describing the history of the theories of dolomite the author calls attention to the frequent occurrence of dolomite in the form of coral reefs, as observed by Dupont in the Devonian, by Richthofen and Mojsisovics in the Trias, and by Dana in the recent raised reefs of Metia in the Pacific. He points out that while in the chemical experiments that have been made with a view of dolomitizing carbonate of lime, *calcite* has always been operated on, the substance of coral has been shown by Sorby to be probably *aragonite*. The author has, therefore, carried out a large series of experiments on the action of the constituents of sea-water (particularly magnesium sulphate) upon aragonite, the results of which are given at full length. From these he finds (1) that a solution of magnesium sulphate, in the presence of sodium chloride, and at a temperature of 60° C. or more, decomposes aragonite with formation of a magnesium carbonate, the exact composition of which is difficult to determine, owing to the impossibility of isolating it from the residual aragonite; (2) that this action increases with the *rise of temperature*, and with the *concentration* of the solution, and is greatly diminished by the absence of sodium chloride; (3) that recent coral is attacked by magnesium sulphate just as mineral aragonite is; and (4) that the lagoons of modern coral reefs offered all the conditions of temperature, saturation, etc., necessary for the production of magnesium carbonate in the manner of experiments, while recognizing therefore, that dolomites may have been formed in more ways than one, M. Klement concludes that one of the most usual ways in nature has been the action of heated and concentrated sea-water in coral lagoons on the aragonite of coral and other skeletons, with formation of carbonate of magnesium, which is subsequently, perhaps after solidification of the rock, with the remaining carbonate of calcium, converted into massive dolomite. (Nature, June, 1895.)

GEOLOGY AND PALEONTOLOGY.

On a New Species of Diplacodon, with a Discussion of the Relations of that Genus to Telmatotherium.—The material forming the basis of this paper consists of a skull with lower jaw (No. 11242, Princ. Collection) found by the writer near the base of the *Diplacodon elatus beds* of Osborn, in the upper Eocene or *Uinta*, of Marsh. The locality is about eight miles north of White River and twenty-five miles east of Ouray Agency, Utah, and is locally known as Kennedy's Hole. Other remains of Diplacodon were found, some of which are of considerable interest, inasmuch as they establish a lower geological range for that genus than has hitherto been accorded it, and indicate a considerable variety of species. Remains of Diplacodon are among the rarest of all the Uinta mammals, and any material which will increase our knowledge of this morphologically interesting genus is most acceptable.

In referring this skull to Diplacodon, I have been compelled to ignore certain characters ascribed to that genus by Prof. Marsh. That author, in speaking of the relations of this genus to the Titanotheriidæ (Brontotheridæ), in his original description of the type specimen, says:[1] "From this family Diplacodon differs widely in its dentition and the absence of horns." In describing Diplacodon as hornless, it would seem that Prof. Marsh's conclusion is entirely conjectural, since his material does not show whether there were horns or not. The present skull has a well-developed pair of frontonasal horns, and, since it agrees in all the characters *known* to that genus, I have preferred to refer it to that genus rather than to propose for it a new one on the strength of this purely conjectural character ascribed to Diplacodon by Prof. Marsh. Should future discoveries show that there are hornless forms with the same dental characters as Diplacodon, it will then be necessary to establish for the present specimen a new genus which may be called *Protitanotherium*.

Diplacodon emarginatus sp. nov.

The type of the present species is the skull and lower jaw above referred to (11242). The posterior region had already weathered out when found and was badly injured, but many of the pieces have been fitted together and show some of the more important characters of this

[1] Am. Journ. Sci. & Arts, March, 1875, p. 247.

region of the skull. Anteriorly both the skull and lower jaw are well preserved, and supplement admirably Prof. Marsh's type of this genus which consists only of the palate and premolar and molar teeth.

The present species is at once distinguished from *D. elatus* by its greater size, as is shown by a comparison of the length of the premolar and molar series, which is 310 mm. in the former and 242 in the latter.

The Cranium:—In general appearance the cranium of *D. emarginatus* is remarkably like some of the smaller forms of Titanotherium. The dorsal surface is slightly concave antero-posteriorly? and is further characterized by the absence of a sagittal crest. The nasal openings are high and deeply incised. The horns are composed of both the frontals and nasals; they are placed transversely and directed upward, outward and forward; they are elliptical in cross-section with the antero-posterior diameter the longer. The nasals are broad, strong and rather short, they are firmly coössified, concave inferiorly, emarginate anteriorly and with their external lateral borders considerably thickened, they do not extend as far forward as the premaxillaries and are slightly constricted just in front of the base of the horns. The premaxillaries are well-developed, are separated anteriorly by a deep median notch back of which they are firmly coössified, they extend considerably in front of the maxillaries. The maxillaries are expanded at the base of the canines and decidedly constricted between this tooth and pm. 2, back of which they expand rapidly in order to accommodate the large posterior premolars and molars. The infraorbital foramen is situated just above pm. 4.

The Lower Jaw:—The rami are closely united at the symphysis which is very long and oblique, its posterior border is just below pm. $\frac{3}{3}$. The anterior mental foramen is situated directly below pm. $\frac{2}{2}$, between it and the premolars there is a slightly excavated and fluted area. The rami gradually deepen from before backwards.

The Superior Dentition:—The superior incisors are placed considerably forward of the canines, and are arranged in the arc of a circle instead of in a nearly straight line as in Titanotherium; they show a remarkable transition from the Paleosyops to the Titanotherium type of incisor. The external, lateral incisors are large, pointed teeth, with strong, internal basal cingula and rather sharp external, lateral cutting edges. The median incisors are much smaller than those just described, but are larger and better developed teeth than the internal lateral incisors which are assuming the rudimentary, spherical form seen in Titanotherium. Both the median incisors and the internal laterals have posterior, basal cingula and a posterior ridge connecting

the apices of these teeth with the cingula. The different degrees of development noticed in the superior incisors would seem to indicate the order of disappearance of these teeth in the Titanotheridæ. The superior canines are large, pointed, conical teeth, nearly circular in cross-section; they are directed almost straight downward, only slightly forward, and scarcely any if at all outward. There is a diastema between the superior canines and pm. 1, which is a very simple tooth fixed in the jaw by two roots, and consisting of a single cone with a posterior heel. The remaining superior premolars and molars are wanting in the present specimen.

The Inferior Dentition:—Of the inferior incisors the median ones are much the larger, while the external and internal laterals are about equal in size; they all have internal basal cingula. The crowns of these teeth are somewhat wedge-shaped, with an anterior and a posterior inclined plane. The inferior canines are very much like the superior, and are directed upward, outward and forward; they are separated from premolar one by a considerable diastema. The latter is a very simple tooth, consisting of a single median cone with anterior and posterior ridges. In the present specimen pm. $\frac{1}{1}$ on the right side is a much smaller tooth than the one on the left. Pms. $\frac{2}{2}$, $\frac{3}{3}$, are becoming molariform, and pm. $\frac{4}{4}$ has already assumed the molar pattern. The inferior molars are identical in character with the same teeth in Titanotherium and need no further description; m. $\frac{3}{3}$ in the type specimen is injured.

The figures in Plate XXXVIII accompanying this paper, were drawn by Mr. Rudolph Weber, and represent accurately the more important characters of the skull and lower jaw of the type specimen. Figs. 5 and 6 are introduced for comparison.

MEASUREMENTS:

The Cranium.

	mm.
Length of nasals from base of horns,	114
Breadth of nasals anteriorly,	123
Breadth of nasals at point of greatest constriction in front of horns,	112
Distance between top of horns at middle of their apices,	151
Transverse diameter of horns at a point midway between base and summit,	40
Antero-posterior diameter of horns at a point midway between base and summit,	66
Length of diastema,	27

The Lower Jaw.

Distance from front of symphisis to anterior border of ascending rami,	385
Depth of ramus below pm. $\frac{1}{1}$,	63
Depth of ramus below m. $\frac{1}{2}$,	110
Length of symphisis,	152
Length of diastema,	26
Distance from base of pm. $\frac{1}{1}$ to anterior mental foramen,	42

The Dentition.

Length of crowns of sup. internal, lateral incisors,	10
Length of crowns of sup. median incisors,	13
Length of crowns of sup. external, lateral incisors,	21
Transverse diameter of sup. canine at base,	26
Length of inf. premolar-molar dentitions,	310
Length of inf. premolar dentition,	107
Length of inf. molar dentition,	203

The Phylogeny of Diplacodon.

Marsh,[2] Osborn[3] and Earle[4] have all agreed in considering *Diplacodon* as ancestral to *Titanotherium*, and the present material only emphasizes the correctness of their views. This is evidenced not only by the structure of the teeth which, as was first pointed out by Marsh, is intermediate between *Paleosyops* and *Titanotherium*, but also by the general appearance of the skull which is strikingly like that of the latter genus, as will be seen by referring to the figures in Plates XXXVIII and XXXIX. This likeness is shown in the great depth of the cranium above the premolars and molars, in the absence of a sagittal crest, presence, shape and position of the horns, breadth of nasals, etc.

Earle, in his very excellent memoir on Paleosyops just cited, has attempted to indicate the phylogenetic positions of the various genera and species of the earlier Titanotheres. In this paper he derives *Diplacodon* from *Telmatotherium*. Later, Osborn,[5] in describing two

[2] New Tertiary Mammals, Am. Jour. Sci. & Arts, March, 1875, p. 246–247.

[3] The Mammalia of the Uinta Formation. Trans. Amer. Phil. Soc., Vol. XVI, pp. 461–572.

[4] A Memoir upon the Genus Paleosyops Leidy, and its Allies. Jour. Acad. Nat. Sci. Phil., Vol. IX, pp. 267–388.

[5] Fossil Nammals of the Uinta Basin. Expedition of 1894. Bull. Amer. Mus. Natl. Hist., Vol. VII, pp. 71–105.

new and several little-known species of *Telmatotherium* from most excellent material secured by Mr. O. A. Peterson, chiefly from the Uinta beds of Utah, has considered *Telmatotherium cornutum* as directly ancestral to *Diplacodon*. He says, on page 72 of the article just cited, "*Telmatotherium cornutum* is in one of the direct ancestral lines leading to the Titanotheres." In a recent paper by Earle,[6] he suggests a polyphyletic origin of the genus *Titanotherium* as had already been intimated by Osborn. Earle, in this last paper, points out very clearly two distinct lines of species of *Paleosyops* and *Telmatotherium* which he considers persistent series and probable ancestors of *Diplacodon* and *Titanotherium*.

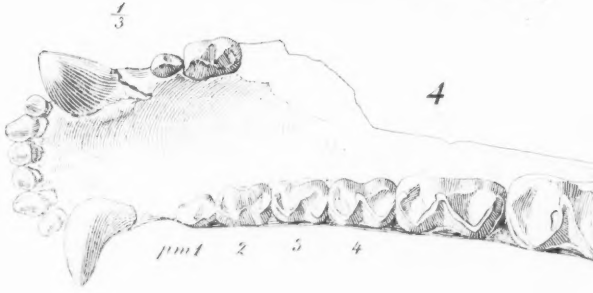
After studying *Diplacodon* in connection with what is already known of *Telmatotherium cornutum*, it seems impossible to accept Osborn's views in regard to the ancestral relations of the latter to any of the later Titanotheres. The *character* of the dentition and the presence of incipient frontonasal horns would, at first, seem to lead to such a conclusion, but a closer study of the material seems to indicate that this is simply a case of parallelism, since, in nearly every other character, *T. coruntum* exhibits features not at all in accordance with what we should expect to find in the immediate ancestors of the Titanotheres; as examples of such features, I would point out, 1, The long, narrow nasals; 2, Convex dorsal aspect of skull; 3, Position of posterior nares which, according to Osborn, are in this species moved backward until they now open far back behind the last molar; 4, The slender and almost parallel zygomata; 5, The presence of an infraorbital shelf; 6, The reduction in the number of inferior incisors to two on either side, while *Diplacodon* still retains three well-developed ones on a side; and Marsh[7] has shown that some of the later forms from near the base of the White River beds still retain three on a side, although quite rudimentary as would be expected. These are all characters of importance, and the position of the posterior nares and reduction of the number of incisors in *T. cornutum* would seem to absolutely prohibit the placing of that species in the direct line leading to the genera *Diplacodon* and *Titanotherium*.

There seems to be little doubt that *Diplacodon* had an earlier ancestry than has heretofore been referred to it, for remains of it are found in the *T. cornutum beds* of Osborn associated with remains of that

[6] On a Supposed Case of Parallelism in the Genus Paleosyops. Am. Nat., July, 1895, pp. 612-626.

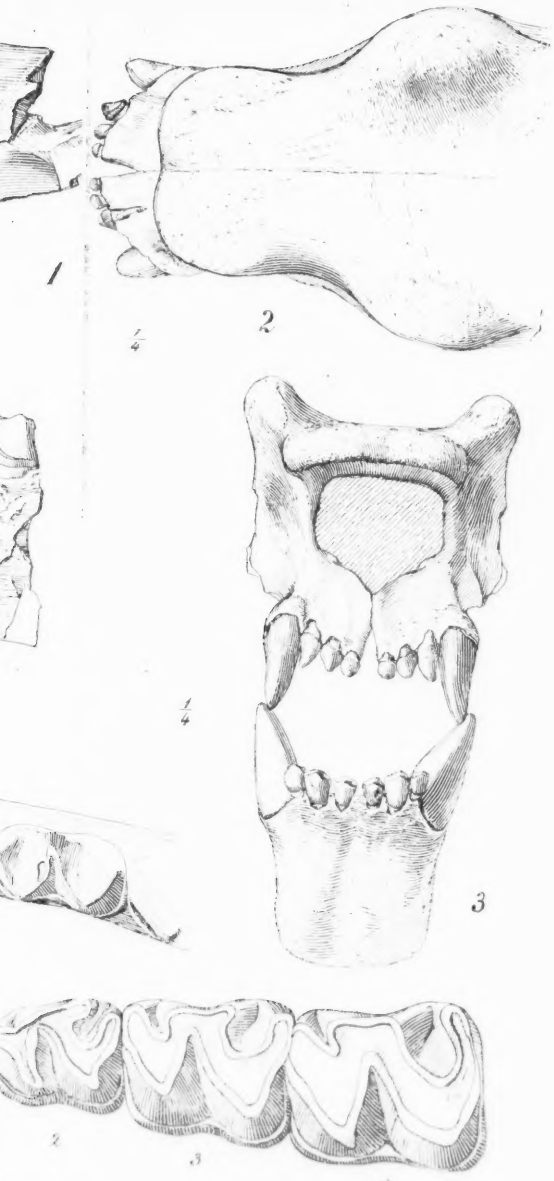
[7] Notice of New Tertiary Mammals. Am. Journ. Sci., June, 1890, pp. 523–525.

PLATE XXXV



Hatcher on Diplaco

XXXVIII.



Diplacodon.

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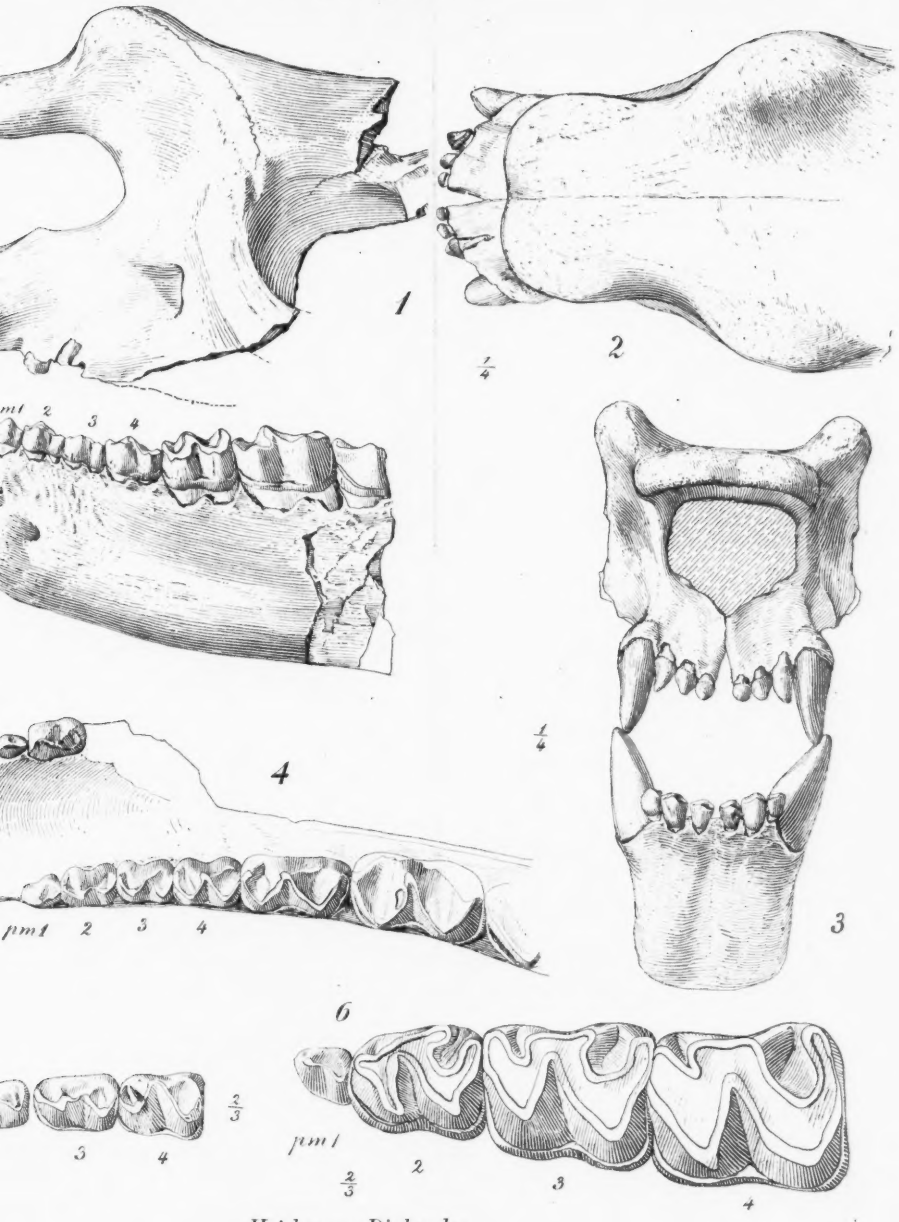
[7] Notice of New Tertiary Mammals. Am. Journ. Sci., June, 1890, pp. 523–525.

pm1 2
1/4

1/3
pm1

5
pm1
2

PLATE XXXVIII.



Hatcher on Diplacodon.

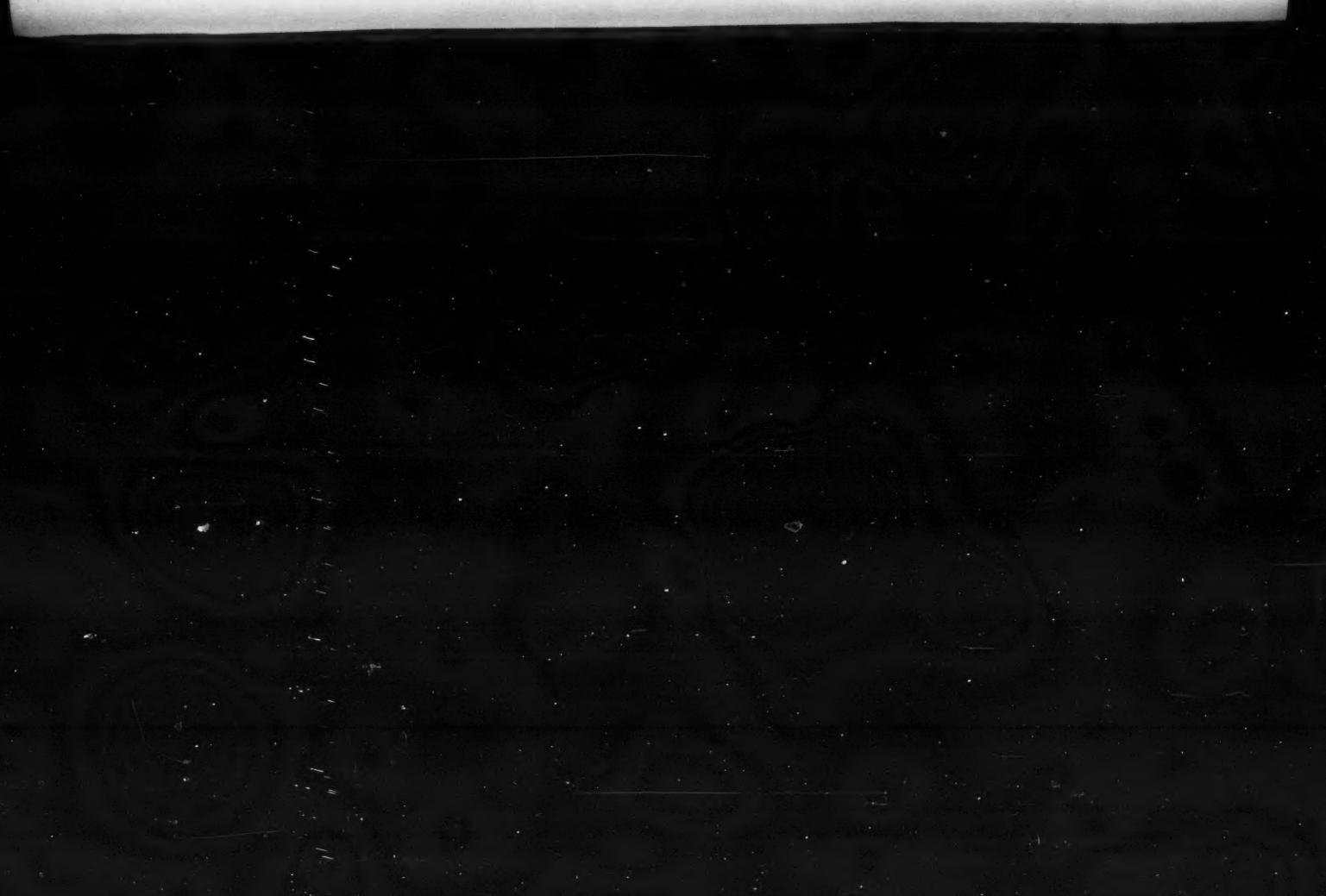
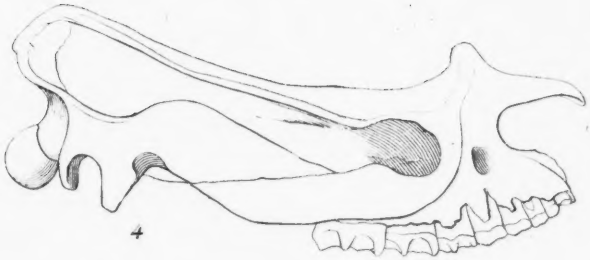


PLATE XXXIX.



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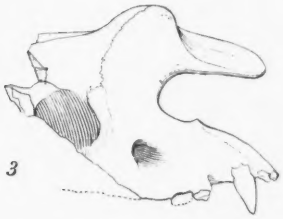

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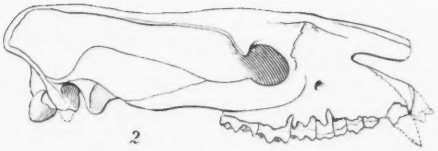
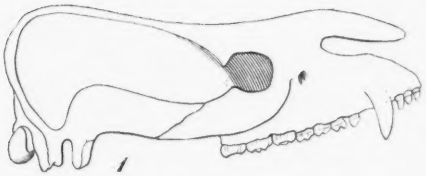
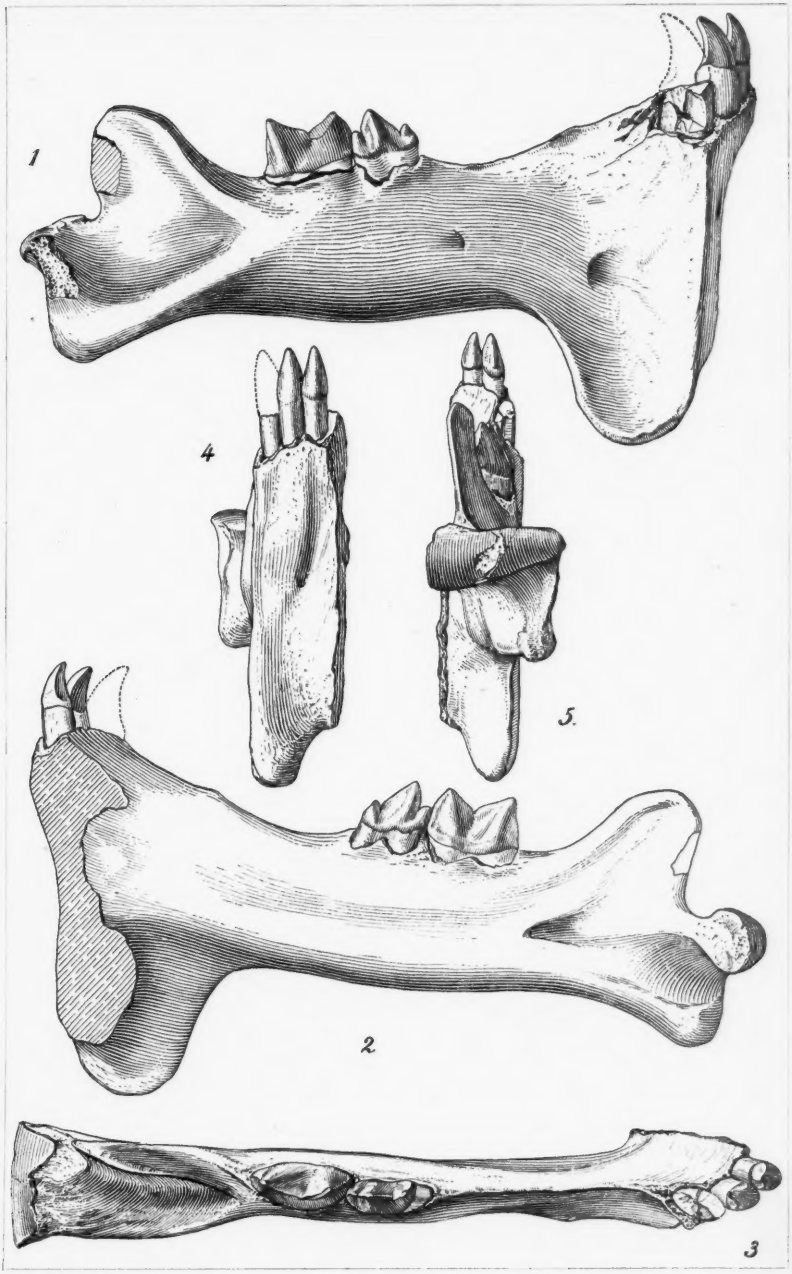


2



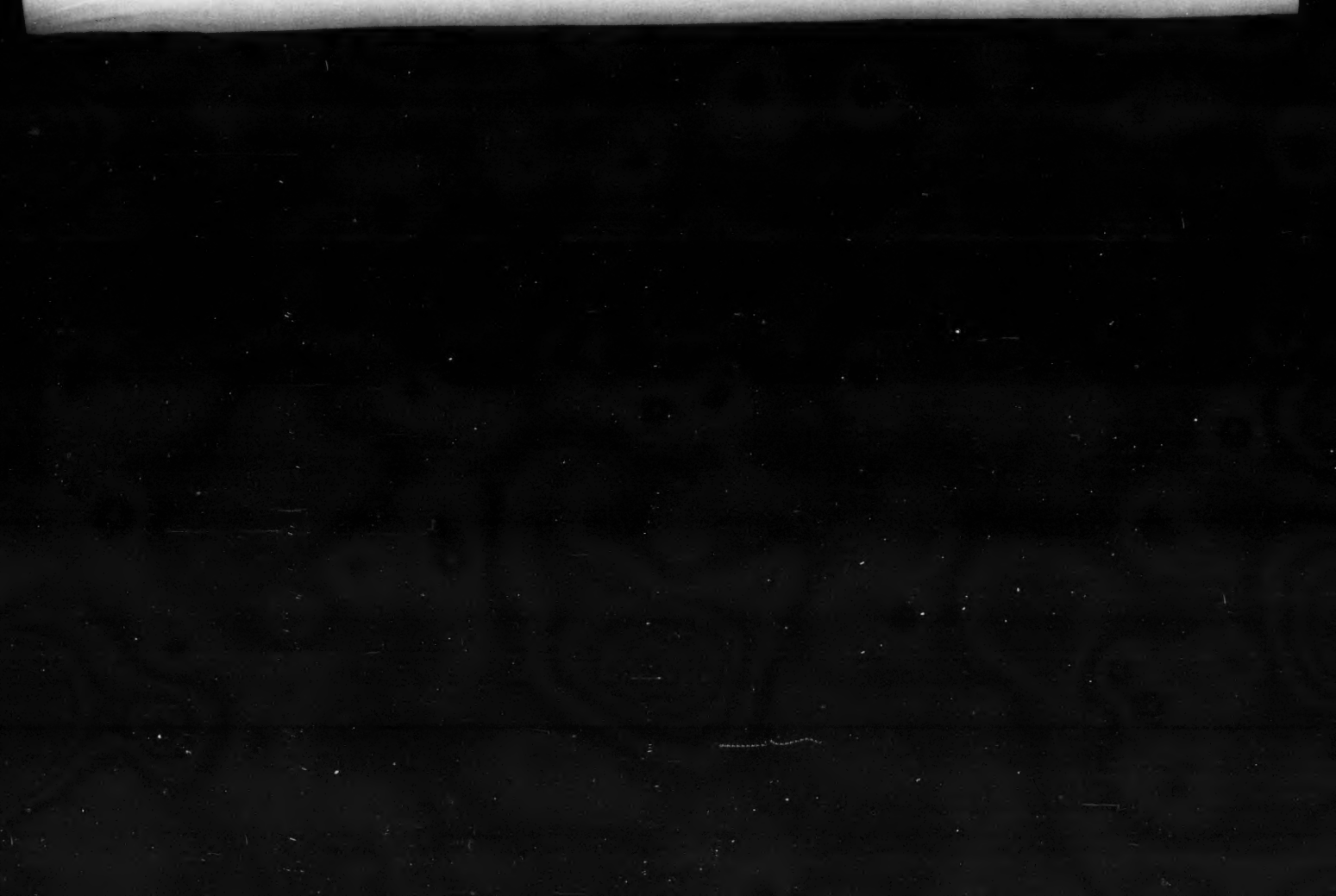
1

Hatcher on Diplacodon.



R. Weber, del.

EUSMILUS DAKOTENSIS, Hatcher.
$\frac{2}{3}$ nat. size.



species, and already at the base of the Uinta proper (*Diplacodon elatus beds* of Osborn) it exhibits a considerable variety of forms. Aside from the two species already known, there are indications of still others, one of which is shown in the pair of nasals (No. 11213) represented in the outline drawing, Fig. 1, with the same portion of *D. emarginatus*, Fig. 2, drawn to the same scale introduced for comparison. Notice the greater absolute and proportional breadth of the former, also the more pronounced medial emargination.

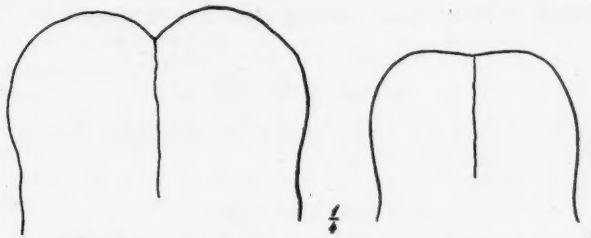


Fig. 1. Sup. view of nasals of *Diplacodon*, sp. ½ nat. size.

Fig. 2. Sup. view of nasals of *Diplacodon emarginatus*. ½ nat. size.

If we compare *Diplacodon* with *Telmatotherium vallidens*, we shall meet with much more consistent results, for in this species we have all the conditions which we should expect to find in the ancestor of *Diplacodon* from the Washakie beds. In *T. vallidens* the sagittal crest is already disappearing, the anteroposterior dorsal aspect of the skull is slightly concave, the zygomata are expanding and becoming stronger, the nasals are becoming broader and shorter, there are incipient frontonasal horns, and there are none of those inconsistent characters so numerous in *T. cornutum*. The Bridger representative of this series was doubtless *Paleosyops laticeps*, which has the concave dorsal aspect of the skull, broad zygomata and short nasals, all characters indicative of *T. vallidens*.

In conclusion, there seems little doubt that the Parallel Series, I and II, established by Earle in his late paper, were differentiated early in the Bridger, and that Series I, of that author, was terminated in the Uinta, most likely by *T. cornutum*; while Series II was continued on up into the White River and terminated in the genus *Titanotherium*. Figures 1, 2, 3 and 4, Plate XXXIX, are introduced to show the successive stages of development from the Bridger to the base of the White River beds. Future discoveries will doubtless close the gaps

between 2 and 3, and 3 and 4, but there would seem to be little doubt that the genus *Titanotherium* has been evolved from the earlier Bridger forms of *Paleosyops* through *P. laticeps* and the intermediate forms *Telmatotherium vallidens* from the Washakie and *Diplacodon* from the Uinta. Vertebrate paleontology rarely shows a more complete series of the stages of development than are to be seen here.

I wish here to thank Prof. Scott for his kindness in placing at my disposal the material upon which this paper is based. My thanks are also due to the various undergraduate and graduate members of the expedition of 1895, whose generosity alone made it possible.

Explanation of Plates.

Plate XXXVIII.

Fig. 1.—Side view of front of skull of *Diplacodon emarginatus.*
Fig. 2.—Dorsal view of same.
Fig. 3.—Front view of same.
Fig. 4.—Crown view of lower jaw of same.
Fig. 5.—Crown view of inf. premolars of *Paleosyops laticeps.*
Fig. 6.—Crown view of inf. premolars of *Titanotherium* sp.

Plate XXXIX. All figures ½ natural size.

Fig. 1.—Side view of *Paleosyops laticeps* (after Earle).
Fig. 2.—Side view of *Telmatotherium vallidens* (after Osborne).
Fig. 3.—Side view of *Diplacodon emarginatus.*
Fig. 4.—Side view of *Titanotherium varians* (after Marsh).

—J. B. Hatcher.

Princeton, N. J., Oct. 29, 1895.

Postscript.

The genus *Telmatotherium* as it now stands should be divided, since it embraces at least three quite distinct forms. The type of *T. vallidens* should be removed from that genus and made the type of a new genus. This new genus may be called *Manteoceras* as suggested by Wortman from the field, it would be distinguished from *Telmatotherium* by the absence of the infraorbital shelf, the stronger and more expanded zygomata and the concave superior aspect of skull and incipient fronto-nasal horns. The type of *T. cornutum* should also be made the type of a new genus which may be called *Dolichorhinus*, it would be distinguished from *Manteoceras* and *Telmatotherium* by the reduced number of inferior incisors, presence of incipient horns, presence of infraorbital shelf and position of posterior nares.—J. B. Hatcher.

Discovery, in the Oligocene of South Dakota, of Eusmilus, a Genus of Sabre-toothed Cats New to North America.—In 1873, Filhol[8] described and figured under the name of *Machaerodus bidentatus*, portions of the mandibles and superior canines of a sabre-toothed cat from the phosphorites of Quercy. Two years later, Gervais[9] described similar remains from the same beds under the name of *Eusmilus perarmatus*. There seems to be little doubt that *E. perarmatus* is identical with *M. bidentatus;* but since the material shows characters which at once distinguish it from the genus Machærodus, Cope has accepted the genus Eusmilus, proposed by Gervais, and retained Filhol's specific name. *Eusmilus bidentatus* may then be considered to include all the known remains of this remarkable feline. Hitherto no American representative of this genus has been reported. In 1894 the writer had the good fortune to discover in the *Protoceras beds* of the upper *White River* (*Oligocene*) deposits a complete ramus which agrees fully in all the generic characters known to *Eusmilus*, and is of interest as being the first American representative of that genus. It differs, however, from the European species in several important characters, and may be called *E. dakotensis*.

Eusmilus dakotensis sp. nov.

The type of *Eusmilus dakotensis* consists of a right ramus (No. 11079, Princ. Coll.). It is in a splendid state of preservation, and all the teeth except the canine are entire. Most of the characters are well shown in plate XL, accompanying this paper, which has been produced from very accurate drawings of the specimen made and placed at my disposal through the kindness of Mr. Rudolph Weber.

Dentition:—I $\frac{3}{3}$, C. $\frac{1}{1}$, Pm. $\frac{1}{1}$, M. $\frac{1}{1}$. The incisors are recurved, about equal in size, and have rather sharp lateral edges. The crown of the canine is gone, but the root of this tooth indicates that it was rather weak, the antero-posterior diameter is about twice the transverse. The alveolar border between the canine and pm. $\frac{1}{1}$ consists of a sharp ridge of bone; it is complete, and demonstrates conclusively the absence of pms. $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$. Premolar $\frac{1}{1}$ is well-developed and fixed in the jaw by two roots; it is directed upward and backward. The protoconid is high and sharp, the paraconid and metaconid are much smaller and about equal in size, the former has a somewhat internal position and is out of line with the other two cusps. There is only a faint indication of a basal cingulum. The sectorial is quite simple, consisting only of a

[8] Bull. Soc. Phys. et Nat. Toulouse, 1873, t. I, p. 205.

[9] Journal de Zoologie, 1875, t. XVIII, p. 419.

protoconid and paraconid. The slight prominence on the posterior edge of the protoconid seen in Figs. 1 and 2, is due to wear by the opposing superior tooth. The protoconid is larger than the paraconid.

The Ramus:—The most striking feature of the jaw is the extreme downward projection of its anterior angle or flange, which is about equal to the depth of the jaw proper. The flange is deeply concave exteriorly, its lateral surface is separated from the anterior by a sharp ridge of bone. The mental foramen opens far down, almost on a line with the inferior border of the ramus. Near the middle of the jaw, and just in front of pm. $\frac{4}{4}$, there is a small foramen directed forward and upward. The exterior surface below the molars is convex longitudinally. The masseteric fossa is deep, and is not enclosed posteriorly. The posterior angle is very strong, it is but slightly deflected, and is directed outward and backward. The condyle is low, being placed a little beneath the line of the alveolar border, it decreases in strength from within outward, and its articular surface describes accurately a reclining semi-cone. The coronoid process is strong, low and rounded. The inner side of the jaw is a nearly plane surface. The dental foramen is situated just back of the sectorial and a little below the middle of the jaw. The symphysis is very characteristic, it extends far down on the flange, and is greatly expanded superiorly and inferiorly, and much constricted medially. The chin was broad and *very* deep. About one-third the distance from the incisive alveolar border to the bottom of the anterior angle of the jaw there is a large foramen.

Eusmilus dakotensis is easily distinguished from *E. bidentatus*, 1, By its size, which is about two-fifths greater than that of the European species; 2, By the structure of the sectorial, which is without the posterior cusp seen in *bidentatus;* 3, By the structure of pm. $\frac{4}{4}$, in this tooth—in *E. bidentatus* the posterior cusp is much smaller than the anterior, while in *dakotensis* these cusps are about equal in size. Compare Figs. 141 and 142, Filhol's Phosphorites du Quercy, with Figs. 1 and 2 in the plate accompanying this paper.

The discovery of *Eusmilus* in the White River beds is additional evidence in favor of referring those deposits to the Oligocene as proposed by Cope and Scott.

MEASUREMENTS:

	mm.
Longitudinal diameter of m. $\frac{1}{1}$, ...	23
Transverse diameter of m. $\frac{1}{1}$, ...	10.5
Longitudinal diameter of pm. $\frac{4}{4}$, ...	16
Transverse diameter of pm. $\frac{4}{4}$, ...	8

Length of diastema,	54
Greatest length or ramus,	173
Distance from top of coronoid process to bottom of jaw,	56
Depth of jaw below sectorial,	33
Width of jaw below sectorial,	16
Distance from bottom of flange to incisive alveolar border,	89
Depth of symphisis,	71
Length of symphisis superiorly,	27
Length of symphisis inferiorly,	21
Length of symphisis medially,	10

—J. B. HATCHER.

Princeton, Nov. 1, 1895.

BOTANY.[1]

The Vienna Propositions.—In the January number of the *Oesterreichische Botanische Zeitschrift* Ascherson and Engler publish six propositions embodying their views upon nomenclature, accompanied by an explanation of the work of the international committee appointed by the Genoa Congress. The propositions themselves have been published quite extensively, but their explanation has not received much notice in this country. The explanation is of some interest to American botanists because it evidently furnished a part at least of the inspiration and even of the language of the recent "protest" of certain botanists against the Rochester Rules. It is also interesting as showing that the committee appointed by the Genoa Congress has practically dwindled down to Ascherson and Engler.

Following is a translation of the "explanation" and of the six propositions.

"Following the appearance of O. Kuntze's Revisio Generum Plantarum in the spring of 1891, a deep movement made itself visible among botanical systematists of all lands. In Germany it led to the inquiry set on foot by the Berlin botanists, in the course of which the four theses sent to over 700 colleagues were answered, for the most part favorably, by more than half of the addressees; by the Scandinavian

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

botanists investigation of the question was recommended to the meeting of Naturalists at Copenhagen; in North America the Botanical Club of the American Association for the Advancement of Science at Rochester adopted a resolution agreeing for the most part with the Berlin explanation. This movement reached its culmination at the International Congress held at Genoa in September, 1892, at which the three first points of the Berlin explanation were agreed to almost with unanimity, and for the settlement of the still controverted questions, namely, the fourth Berlin thesis, as well as the doubt over the naming of species, an international committee of thirty members was chosen to prepare the decision of a future congress by a carefully elaborated statement which should impartially consider all the material at hand.

"Since then the actual interest in the nomenclature controversy seems to have cooled considerably. But the organization of the committee encountered unexpected difficulties. Only a bare majority advocated carrying forward the management of the undersigned. Of the other members of the committee, to our regret, two of the three British members, the representatives of Kew, Sir Joseph Hooker and Mr. Baker, declined election in the committee. Two votes fell to Sir Joseph Hooker as manager. One member, indeed, accepted the choice, but thought that he must abstain from all discord over the management. Some colleagues have left the questions addressed to them unanswered. Discouraging as this result was, yet the undersigned held themselves pledged to undertake the management, as otherwise nothing would be accomplished. By this time it became necessary to produce the requisite means for defraying expenses, which lately was made possible by the munificence of the Prussian Academy of Sciences. If, therefore, O. Kuntze in one of his latest publications accuses us of hiding the questions out of sight in order to neglect them, that is one of the cheap insinuations which we are accustomed to from this gentleman, and which, indeed, is not worthy a thorough refutation. This seasoning of scientific polemic, for him indispensable it seems, and just as insipid as undeserved aspersion of opponents, is employed in profuse quantity in the controversial pamphlet appearing in the last twelve months which O. Kuntze has published as the first part of the third volume of the Revisio Generum Plantarum. In this pamphlet the author has collected all the accessible observations upon the reform in nomenclature undertaken by him and answered them in his manner according to his use of foreign languages. The pamphlet contains also a series of further propositions relating to the reform of nomenclature, among others concerning the constitution of a future congress, and cul-

minates in the proposal of a compromise in that the author explains he will agree to 1737 or even 1753 as the starting point of priority in genera, provided the congress take up his other propositions en bloc.

"Of the other more important observations published in Europe we mention also the memoir of Pfitzer, in which O. Kuntze's nomenclature reform in the region of the orchids is critically examined; O. Kuntze's reply thereto, and a study by J. Briquet of the current nomenclature questions.

"We would meet with little contradiction were we to state as the common mark of these discussions and publications the opinion that the endeavor of O. K. (sic) to replace a considerable portion of the generic names hitherto in use by others and to provide 30,000 species with his mark of authorship, has found little response with the great majority of thoughtful botanists, who hold the reform worse than the alleged evil. The Kuntzean attempts found enthusiastic approval only in certain circles of American systematists who had already inscribed priority *a l'outrance* upon their banners. This tendency seems to have been in the majority at the Botanical Congress held at Madison in 1893, which, on account of the slender representation of Europe, renounced internationality, since this gathering concluded its transactions with a vote of thanks to O. Kuntze.

"But one would err very much if one thought that these gentlemen adopt the Kuntzean nomenclature unexamined. There the specifically American rule 'once a synonym always a synonym' (which is energetically opposed by O. Kuntze, but by Briquet interpolated into the Parisian *lois de la nomenclature* of 1867) has opened up a new source of rebaptisms, through which the number of needless renamings may soon be increased by several more thousands. So we see that the Kuntzean exertions, so far from bringing into the world the harmony striven for by him, have opened the gates wide to dissension and confusion.

"We believe that before we approach the special questions, two closely interdependent fundamental errors must be met, which run through the argumentation of Kuntze and his American friends. The first is the notion that the principle of priority in questions of nomenclature, on account of its intrinsic justice, should be established for the vindication of the spiritual property of the first discoverer or describer. In our opinion this consideration can in no wise hold the first rank in importance. Much more have we established the rule of priority only for this purpose, in order to have an objective standard, since as a rule it is much easier to determine which name was first published for a cer-

tain form than which is the most convenient and suitable. The sense of subjective justice is naturally different with each critic; let one consider only the bitter discussion over the so called Kew Rule or 'objective priority' and the closely connected questions of designations of authority. The one thinks that he who first described a species, or much more he who first named it, has unquestionably rendered the greatest service in connection with it, the other puts the work of the author who first placed a species in the proper genus so high that his name must stand under all circumstances. This cult of priority as a postulate of inherent justice takes on a truly grotesque form with the American theologist Greene; he resembles to a hair the political legitimism over which history has long since passed to the order of the day.

"O. Kuntze appears not to share this romantic conception, although he seems to hold the not less strange illusion of his position over other botanists. He will sacrifice a portion of his 'well earned rights,' but only for the concession that the new congress lay aside its dictatorship. He thinks that he possesses a source of power by which to bring the whole botanical world, present and future, under his yoke.

"The second fundamental error has clearly arisen out of a mistaken conception of the juristic form in which the late illustrious A. deCandolle edited the rules of nomenclature in the form of a statute book. Here also there can be no doubt that only an agreement for reasons of expediency was submitted, which has been followed by the majority of describing botanists by common consent. With what right can Kuntze reproach the Kew botanists who have never recognized the laws with non-observance of these rules?[2] But on no account can the resolutions stand as a law for the enforcement of which the community of botanists must lend their strong hand without refusal, as the state to civil laws. Still less can the defects of this statute book, its silence concerning questions which then were not on the order of the day, be misused for advocates-tricks as, for example, O. Kuntze has done in the matter of beginning priority of genera with 1735. The law says, as we know, that in nomenclature one shall not go back of Linne. Standard works of the master are not specially named. A. deCandolle in his remarks

[2] In this place, as in many others in the article, Messrs. Ascherson and Engler misrepresent Kuntze's attitude. Dr. Kuntze reproaches the Kew botanists because they persist in following their own personal inclinations and refuse to consider themselves bound by any rules—not because having recognized the Paris Code, they violate it. He compares their obstinacy with that of the English people who persist in measuring by yards, feet and inches, after every one else has adopted an international and rational system.—R. P.

of 1883 makes the observation that the terms Phanerogamae and Cryptogamae are to date from 1735, the Linnaean genera from 1737, and the species from 1753. He means this in the purely historical bibliographical sense. In this state of affairs Kuntze now maintains that he has acted in accordance with the laws because he has transferred the species names of 1753 to the generic names of 1737–1752 (we will leave undiscussed the shoving back to 1735 which was so fruitful in new names), and accuses us of revolutionary procedure because we will not allow priority of generic names to be put back of 1753. We can here call upon the most competent testimony that can be adduced upon this question, that of the late A. deCandolle, who prepared the laws, directed the conference over them, and edited the conclusions for the press. If this father of the Paris rules of 1867 has rejected the Kuntzean interpretation, then the question is certainly put at rest. Not less does the Kuntzean position that the rules which were there established concerning the division of genera and like matters, be given retroactive force in interpretation, so that now, for example, the species of *Helianthemum*, because they form the majority of the Linnaean genus *Cistus* must bear that name, and the Miller-Gartnerian species of *Cistus* be rebaptized, conflict, if not with the letter of the Paris resolves, at least with the uninterrupted interpretation of them for nearly a quarter of a century. Here also we hold it self evident that historical development is to be respected—quieta non movere. But these rules of 1867 are to hold when a new monographer reforms the present generic boundaries. So all thoughtful systematists have held from 1867 to 1891, and so will they do also in the future.

"With good foresight, then, did we fix upon the year 1753 as the starting point for genera also in the first Berlin thesis. The American resolution does the same, and both propositions are in full accord with the present practice. As the Genoese congress assented to this decision by a large majority, it is scarcely intelligible how Kuntze sees in this proposition a rash action into which one of the undersigned 'irritated' the congress. Briquet lately opposes these conclusions in a pitiable way in order to argue for 1737. He calls to his aid the Kuntzean argument that 1753 will necessitate the rebaptism of about 6000 species, while by beginning with 1737 a much smaller number would be required. Naturally alterations of the Kuntzean nomenclature are meant. But a comparison can only be made with the nomenclature current before the appearance of the Revisio, and thus it appears that 1737 makes a greater number of alterations necessary than standing upon the starting point hitherto commonly adopted, at least de facto.

"Already two years ago we called attention to the fact that the establishment of 1753 did not suffice to restrain a large number of disagreeable rebaptisms of the best known and most numerous in species of genera. We then as a fourth thesis made a list of 80 (81) genera, the current names of which we wished to retain in spite of priority. This thesis was not adopted at Genoa. It had previously found opposition among the Vienna botanists, and had united against itself the greater number of opponents in the Berlin inquiry. We believe that this opposition is directed against the arbitrary selection; while the purpose, the protection of current names against alterations in majorem gloriam of an abstract principle, as inconvenient as unnecessary, has met with the approval of many of the dissenters. Who can wish sincerely that the abstruse word-buildings of an Adanson, the doctrinaire creations of a Neckar (who strove to obscure the conception of a genus as it had stood well-defined since Tournefort and Rivinus) and the hasty improvisations of a Rafinesque should replace names some of them current for more than one hundred years? We believe that in this case the narrowing of the rule of priority for genera by introducing a year limitation will lead to our goal. One can see an inconsistency here, namely, that we do not propose this year limitation for specific names also. Yet we believe that here also, considerations of convenience must take precedence of abstract symmetry. For half a century men have labored zealously to determine the meaning of Linnaean species and of the species of the older authors by a careful study of their writings and of their collections. These studies were only made possible by the most exact knowledge of the forms concerned; which one certainly cannot assert of the efforts of Kuntze and his imitators which are for the most part based only on bibliographic researches. The result of all these labors which has already met with abundant general acceptation, would be lost, and long vanquished errors would resume sway if we were to introduce the year limitation (naturally with retroactive force) for species also. The inconvenience of such a rectification of priority affects only as a rule a single name, sometimes two, more seldom a larger number. In the case of genera a similar 'correction,' which in no way concerns the scientific knowledge of the types in question, may often lead to the rebaptism of two hundred names.

"Moreover, theoretical reasons can be adduced why genera should not receive precisely the same treatment in nomenclature as species. Only a few would defend the absolute application of the principle of priority to the naming of families, orders and classes. Now, since in these cases, the considerations for priority fail, it is an entirely reason-

able distinction to hold that while with genera priority shall rule, nevertheless where reason would become unreason and benefit vexation it be restrained by a year limitation, and yet in the case of species rule unrestrained.

"A different treatment of priority for genera recommends itself also with respect to the debated starting point of the same. We have already mentioned the important considerations of convenience which speak for 1753; nevertheless, there are numerous adherents of 1737; there have been and will be some for 1735, 1694, 1690, and, perhaps, for still other dates. Each of these starting points would naturally require a special generic nomenclature.

"It is also to be noticed that the conception of the genus is much less defined and, therefore, more inconstant than that of the species. What alterations have the ideas of genera in the Cryptogams, excluding the ferns, in the *Gramineæ*, *Orchidaceæ*, *Umbelliferæ*, *Compositæ*, *Cruciferæ*, etc., undergone since Linné. For these groups, therefore, our proposition comes to the same result as the proposals which would have the priority of groups begin with this and that monograph. Also the disagreeable double-namings in the *Proteaceæ*, in which by Kuntze's own statement Knight and Salisbury, the authors he has raised upon his shield, do not seem at all free from the suspicion of plagiarism, would be put out of the world.

"Moreover, by the adoption of a period of limitation, the addition to the second Berlin thesis resolved upon at Genoa at Prantl's suggestion will become superfluous. This, as it must be confessed, somewhat improvised proposal directed its point against Adanson; but it affected as well Haller, Scopoli (in part), and many other authors whose names are well known.

"Besides, even O. Kuntze has nothing to oppose to a limitation principle, provided only his restorations are excepted from it!

"It is self evident that the endeavor to alter the current nomenclature of genera as little as possible, which has moved us to propose a period of limitation, must not fall into opposition with itself. Such an opposition would occur if a name for a long time in common use should be rejected by reason of the rule, since, perhaps, after it had remained unobserved for a long time it might be restored once more. It is necessary, therefore, to fix a limitation for this and analogous cases.

"By fixing both periods at fifty years, the greatest number of the names applied in DeCandolle's Prodromus will be allowed to stand, and most of the 6000 rebaptisms calculated by O. Kuntze as required by 1753 will fail.

"We summarize the results of the foregoing discussion in the following rules:

"1. The rule that a name once applied but later becoming invalid must not be used again is to be recommended for observance in the future; but retroactive force is to be denied to this rule (once a synonym always a synonym) and alterations of names based upon it are to be rejected.

"2. On the transfer of a species out of the original genus into another genus, the original specific name is to be retained.

"3. The year 1753 is to be retained as the starting point of priority for both species and genera.

"4. In the nomenclature of species the principle of priority is imperative; only a more certain name must not be replaced by a doubtful one.

"5. In the nomenclature of genera a name which has remained unnoticed for at least fifty years, cannot later be established in the place of one which has become current.

"6. This rule allows an exception where the name in question, since its restoration, has remained in use at least fifty years.

"These rules as well as all other proposals proceeding from the committee after they have been passed upon by the committee, require the approval of a future congress.

"It is much to be desired that botanical nomenclature be placed in the closest possible accord with the system of nomenclature now under deliberation by the zoologists.

"P. ASCHERSON,
"A. ENGLER."

"Vienna, September 21, 1894."

(*To be continued.*)

VEGETABLE PHYSIOLOGY.[1]

Macfarlane on Paraheliotropism.—As the result of a series of interesting experiments, described in *Botanisches Centralblatt*, Bd. 61, 1895, under the title of "The Sensitive Movements of some Flowering Plants under Colored Screens," Dr. J. M. Macfarlane, of the Univer-

[1] This department is edited by Erwin F. Smith, Department of Agriculture, Washington, D. C.

sity of Pennsylvania, finds that the hot sun position assumed by sensitive plants is not due to the action of solar heat rays, as a number of observers have stated, and as he was himself formerly inclined to believe, but to the more refractive rays of the solar spectrum. His studies were made upon *Cassia nictitans, C. chamæcrista, C. tora* and *Oxalis stricta*, and some of his conclusions are as follows:

"In all cases it has been found that Sachs' statement is so far correct, viz.: that when sensitive plants are placed under colored screens the leaflets fold as in the nyctitropic state, most powerfully under red, less so under yellow, only feebly or not at all under green, and that under blue screens the leaflets remain open as in ordinary daylight. But expansion under the red and yellow screens soon takes place, the rapidity of the expansion varying according to the brightness of the light and the species experimented on." "If the light be diffuse, and thus of moderate intensity, the flat morning position of the leaves is retained throughout the entire day, or part of it if the sun ultimately shines out." "If the light becomes more intense, no alteration, or it may be slight deflection in *Cassia* or inflection in *Oxalis*, occurs to leaflets of plants under the red and yellow screens. When plants are under a green screen and exposed to intense illumination. the leaflets either remain flat or assume a more or less paraheliotropic position, the angular change at times amounting to 25°. In all cases under the blue screens the leaflets become paraheliotropic more or less powerfully, the amount of angular movement being proportioned to the intensity of the light. It is impossible at present to say whether the blue or violet rays are the more powerful. In all cases, normal nyctitropic movement is accelerated a half to one and a half hours under a red screen, but the movements of the leaves and leaflets then are very peculiar." "Under a yellow screen nyctitropism is not quite so accelerated as under red, but the closing movements are nearly or quite regular in sequence, and in Cassias are first visible at the leaf extremity. Under a green screen the time movement practically coincides with that of exposed plants, and is beautifully regular in sequence." "Under the blue light there is always a distinct retardation of the normal nyctitropic period to the extent of from ½ to 2½ hours, the variations seeming to depend on temperature, on length of exposure to the blue light, and on relative intensity of the light for the day." "These observations seem further to warrant us in concluding that up to 38° C., or even 43° C. in some species, heat rays either fail to stimulate the tissues, or if they do that, their action is interrupted aud antagonized by some other form of energy, though this is scarcely likely. The same is true

of the less refrangible light rays, and of these the orange-yellow, yellow and yellow-green seem to give the most uniform results, for so long as plants were exposed to intense light the leaflets remained either quite flat or became slightly reflexed. Under the green screen the leaflets of *Cassia nictitans* and *C. chamæcrista*, when strongly illuminated remained flat or became inflexed in some cases to 25°, but those of *C. Tora* under equal illumination inflexed through an angle of 15° ; those of *Oxalis stricta* remained flat. The parahelіotropic movement thus started under the green screen in some species became greatly more pronounced under the blue in all, and during intense illumination in *Oxalis* almost amounted to the nyctitropic position. Grouping the above facts, the conclusion is reached that the heat rays, the less refrangible rays, and the more refrangible rays are all trophic up to a certain point. When that point is crossed the heat rays and less refrangible rays continue to be trophic up to a much higher point, but the more refrangible rays (from green-blue to violet) act as a stimulant or irritant." "It may be worth emphasizing here that sensitive movements are most pronounced in tropical plants, are less so in subtropical and warm-temperate species, and are rare or feebly expressed in temperate and sub-arctic plants. But, as is well known, leaves that are exposed to an intense light show more rapid metabolic changes than those that are shaded. Any change, therefore, in the tissues of a plant which would insure protection of the lamina from the intense blue-violet rays, and its exposure again when these rays become subdued, would have every likelihood of perpetuation in sub-tropical and tropical regions, and such is the state of matters as we find them. We do not know accurately, as yet, the mechanism involved in a sensitive pulvinus, or the changes effected on stimulation of it, but anyone can readily prove that every gradation from non-sensitive to highly sensitive leaves is met with in such groups as the Oxalideæ and Leguminosæ, and that, broadly speaking, the sensitiveness increases as we pass from regions where the sun's rays are of minor intensity to others where the rays are of increased intensity. The writer, therefore, regards the action of the more refrangible rays, when of a definite intensity, as one of stimulus, because (1) the angular inflection of leaflets is proportionate to the intensity of the stimulating rays ; (2) the movement is not due to indirect action from the green laminar substance to the pulvinus cells, but is wholly centered in the latter ; (3) if the inflection movement is considerable, the white cushion of the pulvinus shows a visible change from white to a dull leaden green color ; (4) when the more refrangible rays are cut off by a color screen the stimulus is removed, and then

neither the heat rays nor the less refrangible light rays cause closure. The above experiments then indicate that by the paraheliotropic movement leaflets are protected from the intense action of the blue-violet rays, and for this end all the leaflets on any one leaf need not move through the same angle." "These observations emphasize the view already expressed by several investigators that orange, yellow, and green screens to the protoplasm, whether in the form of pigmented walls, of pigmented cell sap, or of chlorophyll are of a protective character, and permit the normal functions to be carried on unimpeded by the action of the more intense blue-violet rays. But while such pigments are specially effective, the writer would suggest a similar function for the thick, highly cuticularized epidermis that covers so many desertic plants, or plants that grow in places exposed to intense sunlight. One can easily prove by experiment that on a hot day a thin sheet of white paper considerably reduces the light intensity. A piece of *Opuntia* epidermis similarly obstructs the light rays, and even though the heat rays pass, we have seen that up to 40–43° C. no injurious effect follows to many plants. It might further be pointed out, as Wiesner has already done, that the hair covering on the leaves of certain plants will contribute to the same end." The location of the movement in the pulvinus was determined by shading this organ from the direct action of the sun by narrow strips cut from an oak leaf. When the pulvini were thus shaded, leaflets that were inflexed 45 to 50° re expanded in a few minutes so as to form an angle of only 5 to 10°. The time required to effect this change of position was only 1⅝ minutes in *Cassia nictitans* and 2½ to 2⅝ minutes in *C. chamæcrista*, depending on the age of the leaf. Strips of mica of like weight caused no movement."—ERWIN F. SMITH.

Chalazogamy in Juglans regia.—Some years ago in *Casuarina* a peculiar genus of Australian and East Indian trees, diœcious, bearing aments, having the foliage reduced to scales, and superficially resembling Equisetaceæ, Dr. Treub discovered that the pollen tube does not enter the ovule by way of the micropyle but finally reaches the egg-cell by growing through the chalaza. This peculiar and altogether anomalous method of fertilization led him to found a distinct group of Angiosperms, sub-division *Chalazogamia* equal in rank with subdivision *Porogamia*, including the rest of the Dicotyledons and Monocotyledons. Subsequently, Dr. Nawaschin, of Kiew, Russia, discovered that the same thing occurs in the Betulaceæ, and now in Ein neues Beispeil der Chalazogamie (*Botanisches Centralblatt*, Bd. 63, 1895, pp. 353–357) the same author states that he has found chala-

zogamy in *Juglans regia*. The large ovule is anatropous. The placenta fills the ovary and frequently fuses with it. From the sides of the placenta develop two peculiar wing-like growths projecting somewhat above the base of the ovule. The pollen tube is strictly intercellular in its growth as in the other Chalazogamia. After the tube has penetrated the stigma and grown through the style, it enters the tissue of the ovary near the canal of the style but without entering its cleft or penetrating the micropyle. During its further growth, in the wall of the ovary, the tube turns to right or left and passing through the wing-like placental growths enters the top of the placenta and from here grows through the chalaza into the nucellus and to the embryo sack. During nearly its entire growth the tube sends out projections and in the chalazal region these become branches which give to the nucellus a veined appearance as if penetrated by a number of distinct pollen tubes. Several of these branches finally reach the embryo sack and surround it on all sides. The author detected the male nucleus, not only in the pollen tube, but also inside the embryo sack. At this time there was in the embryo sack neither an egg apparatus nor a differentiated egg. Besides the antipodal cells, separated from each other by a cellulose membrane, there were only some free nuclei on which devolved the rôle of the female apparatus. These appearances can hardly be explained otherwise than by supposing that the male nucleus fuses with one of the female nuclei to form the egg-cell. In these particulars *Juglans* (also *Corylus*) appears to be related to *Gnetum*, the developmental history of which has been studied critically of late by Geo. Karsten (Cohœn's *Beiträge*, VI). The author now attributes chalazogamy to the inability of the pollen tube to grow through empty spaces, and regards these plants as standing on the threshhold of the angiospermous world. To him they represent transition forms between Gymnosperms in which the pollen tube has an intercellular growth and Angiosperms in which it grows through the mycropyle.—ERWIN F. SMITH.

ZOOLOGY.

Variation in Halicystus octoradiatus.—Among 154 specimens, according to a recent paper in the *Quarterly Journal of Microscopical Science*,[1] Mr. E. T. Brown found 120 normal and 34 abnormal

[1] Vol. XXXVIII, pp. 1–9, Pl. I.

specimens, the normal individual being understood to be one with eight tentacle groups, eight genital bands, eight colleto-cystophores and four well-formed septa. The variations occur in the tentacle groups, the genital bands, and in the number and position of the colleto-cystophores. In some cases there is an extra collecto-cystophore, which may be on the edge of the arm of the tentacle group, or within the margin the inner surface of the bell, or even outside the margin. A peculiar variation occurs in the collecto-cystophorus, themselves some of them sometimes bearing a small capitate tentacle. The variation in the genital bands may be due to an apparent splitting of a band or even to a fusion of one band with a ninth or supernumerary one. Two variations in the tentacle groups are interesting. In one individual figured there are seven perfectly normal groups, and one abnormal rather small group occupying a position within the margin upon the inner surface of the bell. Its normal position on the margin is occupied by a large colleto-cystophore with a capitate tentacle. In the other case there are likewise seven normal groups. The eighth is normally placed, but is small. Somewhat outside of it there arises a supernumerary arm bearing an apical group of tentacles and another or proximal group. On each margin of the arm is a colleto-cystophore, thus raising the number of these to ten. It may also be said that the eighth genital band corresponding to the abnormal tentacle group is double.

The author adds that mutilated individuals may reproduce a part that is or is not like the original, and that in some cases these mutilated forms bears a close resemblance to others that are congenitally abnormal. This being the case, it may be said that his observations show that there is considerable room for experiment to determine why the reproduced part is not like the original, and to what extent it may differ.

—F. C. K.

The Role of the Liver in the Anti-coagulating Action of Peptone.[2]—E. Gley and V. Pachon have performed certain experiments that not only demonstrate the correctness of the earlier conclusions of G. Fano, that the anti-coagulating action of peptone injected into the blood of an animal is indirect, but also localize the intermediate agent. The experiments consisted in ligaturing the lymphatic vessels leaving the liver in a dog previously morphined and chloroformed, and then at intervals drawing blood from the left carotid and from the sphenal vein.

[2] Comptes-Rendus de l'Acad. Sci., CXXI, pp. 383-5.

At 3.42 (p. m.), 6 c.c. of blood from the carotid coagulated at 3.43.

At 3.50 to 4 (p. m.) the lymphatics were ligatured.

At 4.09, 8 c.c. of blood coagulated at 4.10.

At 4.22, 5 c.c. of blood coagulated at 4.23.

Then from 4.23–4.26 a solution of 6.5 gr. of peptone was injected into the sphenal vein. At the end of this time blood was drawn at intervals.

7 c.c. drawn at 4.33 coagulated in 1 minute.

8 c.c. drawn at 4.40 coagulated in 1 minute.

8 c.c. drawn at 4.55½ coagulated in 1½ minute.

This clearly shows that by thus preventing the intrahepatic circulation of the lymph, the peptone loses its power of preventing the coagulation of the blood, and consequently that peptone has its usual effect only after having passed through the lymphatics leaving the liver.

—F. C. K.

The Neoformation of Nerve-cells in the Brain of the Ape after a Complete Removal of the Occipital Lobes.[3]—It has commonly been supposed that nerve-cells are not regenerated, and such was the conclusion of G. Marinescu presented to the Société de Biologie in 1894. But physiololgists have observed that animals deprived of the occipital lobes gradually regain the power of coördination of movements and of the recognition of surrounding objects to a degree, at least.

The author, on Aug. 24th, 1895, observed this phenomena, and, upon repeating the operation, was surprised to find the orifices of trepanation closed with a somewhat resisting tissue, and that the space formerly occupied by the occipital lobes had been refilled with a tissue that, upon examination with the rapid Ramon y Cajal Golgi method and by the Erlich hæmatoxylin eosin method, proved to be made of pyramidal nerve-cells and nerve-fibres and neuralgia. The latter was very abundant, while the former were less numerous than in the normal lobes. The growth was not due to the hypertrophy of the anterior lobes, for there was no clear microscopical demarkation between the two parts, and must therefore have been due to neoformation.

He adds that this explains, somewhat, the conflicting results of different observers in cases of incomplete removal of the lobes.

The operation of removal was repeated on the animal, and some three and a half months later the same phenomenon of reviving recognition reappeared.—F. C. K.

The Æstivation of Snails in Southern California.—Like the human genus, snails require rest, days and weeks of solitude, in

fact, the land snail (Helix) withdraws so completely from social intercourse that months are spent in voluntary confinement. So secluded does this little householder become that his door or aperture is closed with one white curtain after another until sometimes one-half a dozen membranous curtains in succession are draped when he has entered into his Nirvanic rest. In this condition his aperture, or outer door, is securely glued to the under surface of a stone, a board, or any substance under which he seeks shelter. In the eastern states he takes his annual *siesta* in winter, this being the period of hibernation.

But in Southern California snails (Helix) differ from their congeners presenting an illustration of the power of environment over natural instincts. Instead of going into winter quarters in October and remaining asleep all the winter months, the season of greatest activity of the Southern California snail is during those months.

The reason for this is that the food supply is plentiful in the winter when the warm rains prevail; but, during the summer months the arid condition of the foot-hills, the habitat of these quiet creatures, makes makes the æstivation of snails a necessity, a question of domestic economy, an adjustment of demand and supply. In process of time the necessity for æstivation, rather than hibernation, became a habit. During this period his functions are in a state of coma; digestion, respiration and circulation are imperceptable; he sleeps with all his powers, and his waking is not a voluntary action. Without moisture a snail will rest for years! Dr. R. E. C. Stearns, of the U. S. National Museum, records a rest of six years of one snail from Lower California, *Helix veatchii.*

On March 21, 1890, a few land snails (*Helix traskii* Newcombe), were collected from some of the low foot hills in Los Angeles. These were left in a glass jar on a stand and in the morning the snails had crawled up the wall of the room and were esconsced in one corner of the ceiling, another one had travelled farther in the night and had pre-empted his claim in one corner of the hall ceiling. They were allowed to remain undisturbed in order to study developments. One soon fell down upon the carpet, but the other two remained intact. The household orders were that *Helix traskii* were to be left undisturbed by brush or broom. The summer came and went, autumn followed, winter came on, and still the hermaphrodites remained asleep. No sound of music nor mirth aroused them.

But the rains came on, heavy drenching showers that rushed down the mountains, washed the foot hills, overflowed the zanjas, and all nature was in a dripping condition. During one of these storms, in

January, 1891, the rain made invidious incursions into the hall during the night, and in the morning the snail was found on the carpet. In an hour afterward he was as willing as ever to struggle for existence. He ate heartily of celery, with his little rasping tongue (radula) beset with multitudes of tiny siliceous teeth.

It was not until February 23, that the other snail had been sufficiently overcome by the forces of nature to loosen his epigram enough to descend to the floor. He was then placed in a shallow saucer of water and he assumed his functions as though there had been no state of torpor.

While the house snails were glued to the ceilings, their relatives in a "snailery" in the garden had been aroused to activity by the first rain as it pattered through the screen cover of the snailery, and had been busy housekeeping. As the result, a number of tiny pellucid looking balls were, on January 21, 1891, carefully hidden in the moist earth in the box. These were the eggs of the snails. Time had been lost by the house snails, their siesta, extended beyond the requirements of Nature, had gained them nothing. It was the intention to study all these forms and see if the "house snails" lived any longer for their protracted æstivation, but, alas! for the rapacity of the animal kingdom, slugs, sow bugs, ants and insects from the rosebushes, made war upon the whole snail colony, adults, babies and eggs, and by summer time, the little houses were empty, the tenants were dead.—Mrs. Burton Williamson.

A Careless Writer on Amphiuma.—I have recently read an article in the last number (October, 1895) of the American Journal of Morphology by Mr. Alvin Davison on Amphiuma, which contains such evidence of haste and carelessness as to require early notice. At present I refer principally to his references to my work and my conclusions, but as the errors here are so numerous I cannot suppose that I am the only author favored by misrepresentation,

On page 378 he says, "the number of premaxillo-maxillary teeth is never less than fifty. The number is wrongly stated by Cope as thirty-one." I have recounted the teeth on the specimen which I had in hand when this assertion was written, and I find the number to be exactly as I have stated. Mr. Davison has probably counted the teeth on *both sides* of the skull. One would think that a little scientific imagination would have suggested this explanation of the discrepancy to Mr. Davison.

Our author next describes the squamosal bone of Amphiuma, putting his discoveries as to its shape in italics, as though it had not been often

described and figured before, and then goes on to say that "the bone which Cope has called squamosal in the Cœcilians is quite differently located, being directed forwards and inwards in such a manner as to form part of the orbit, and, therefore, deserves the name of quadratojugal, as some authors have already called it." It is at least amusing to learn that to contribute to the orbit is characteristic of the quadratojugal bone. That is exactly what it never does; and, moreover, the squamosal does not do so in Cœcilia. That the element in question is the bone which is called in Batrachia generally by modern authors the squamosal, there can be no doubt; I prefer however, at present, to call it supratemporal. Mr. Davison's osteology is here seriously at fault.

On page 383 the author states that "doing the past six months I have searched carefully for a description, or even a few words of introduction to the muscular system of this strange animal, but have been able to find only a very terse discussion of the subject." He then refers to Bronn, who gives he says "only a few words to the muscles of the head." It is evident that this search was not very careful, or Mr. Davison would not have missed so important a work as Fischer's Anatomische Abhandlungen ueber die Peremibranchiaten und Derotremen 1864, where much space is devoted to the muscular system.

On p. 390 we read "Cope has greatly erred in saying that the lungs are subequal." I find on reexamination of adult specimens that the left lung is only one-tenth shorter than the right.

On p. 395 is another error, which would suggest animus, were not the author's capacity for blundering so exceptionally developed. He says "Cope has asserted that Amphiuma has only one testis, but I find paired testes extending half way from the liver to the vent." It does not appear to have occurred to Mr. Davison that I was describing one side only, and that I stated it to be single in order to distinguish it from that of Siren, where there are two on each side.

On page 403 we have a discussion of the phylogeny of Amphiuma. He gives my table of the Urodela from the "Batrachia of N. America," and then remarks. "It is evident to all phylogenists that this table presents an absurdity, since representatives of each of the five families in the direct line of descent are existing at the present time." On the contrary this naïve observation shows that Mr. Davison is a tyro in phylogeny. He does not seem to be aware that families of many vertebrata, and especially of the lower classes, often have had a long duration in geologic time. Thus in the American Oligocene occur genera of the existing families of lizards, Gerrhonotidæ and Amphisbaenidæ,

and existing families of Batrachia are known from the Miocene. But when Mr. Davison wishes to derive the immediate descent of Cœcilians from the Stegocephalia, he goes to an opposite extreme of antiquity, and, moreover, there is no resemblance whatever between the two groups. Even if the Cœcilians possess a basisphenoid as he alleges, but which I greatly doubt, this character would constitute a ground of difference from the Stegocephalia, and not resemblance.

Finally our author, in order to set forth his views of the phylogeny of the class Batrachia, copies bodily, p. 407, my diagram as published in the Batrachia of N. America, without credit, only introducing the two absurdities of deriving the Amphiumidæ and the Cœciliidæ from the Stegocephalia direct.

Mr. Davision has, in fact, adduced some new reasons in support of the proposition which I was the first to formulate, that Amphiuma is nearly related to the Cœciliidœ. So certainly have his researches with those of the Sarasins and Hay confirmed this view, that it is quite worth while to reëxamine the supposed ethmoid of the Cœcilians, and see whether there is not an agreement in this point also.

At the close of the article the author states that Dr. Scott has pointed out parallelisms in evolution of different lines of Mammalia. Dr. Scott has never claimed that his observation was original with himself, and if Mr. Davison had asked the distinguished Professor of Princeton as to this, he would have learned where and by whom this fact of phylogeny was first set forth.

Finally, the plates attached to this paper are quite unworthy of the American Journal of Morphology.—E. D. Cope.

Zoological News.—Those interested in the anatomy of the frog will find Gaupp's account of the hand and foot muscles of that animal (Anat. Anzeiger, Bd. XI, No. 7, Oct., 1895) extremely valuable, and the illustrations which accompany it are very clear. No abstract is possible.

P. J. White adds[4] *Hexanchus griseus* to the list of Selachians (*Notidanus indicus*) in which a median cartilage is inserted in the shoulder girdle. Like Haswell and Parker, he regards it as sternal in nature, and consisting of pre- and post-omosternal elements.

[3] Vitzon, Alex. N. Compte-Rend. Acad. des Sci., CXXI, 1895, p. 445.
[4] Anat. Anz., XI, 222, 1895.

ENTOMOLOGY.[1]

Stemmatoiulus as an Ordinal Type.—The genus Stemmiulus[2] was established by Gervais in 1844. The type species was collected in the mountains of the United States of Colombia. The genus was supposed to differ from Iulus in the possession of a single large ocellus on each side, instead of a cluster of small ocelli, but to subsequent writers this seemed a rather slender basis of generic distinction. Latzel placed Stemmiulus as a doubtful subgenus under Iulus.

Other species with two large ocelli have been described from Jamaica and Ceylon by Karsch and Pocock, but no dissections seem to have been attempted. Mr. Pocock has given me credit for having pointed out to him the fact that the pleural sutures are open, and he has established a separate family for the accommodation of the genus, having previously referred it to the Callipodiæ (Lysiopetalidæ) because the ventral plates are free and the segments striate in a manner resembling that of some of the European Lysiopetalidæ. Mr. Pocock also established[3] a suborder Callipodoidea to contain the Callipodidæ and Stemmiulidæ, but seems later on to have abandoned this arrangement, for we find both families referred back to the Iuloidea.[4]

During the past four year I have had the opportunity of accumulating in Liberia abundant material in this group, and have accomplished several dissections which reveal a series of remarkable characters, and make possible camera drawings of the interesting parts.

The living animals strikingly resemble in form, size, coloration, habits and movements the Iuliform Craspedosomatidæ, such as Cryptotrichus and Underwoodia. No Craspedosomatidæ are, however, found in tropical Africa, so that mimicry will hardly explain the apparent similarity of these really diverse forms. The movements, indeed, are even more vigorous than those of Craspedosomatidæ, and the creatures frequently throw themselves several inches when disturbed. Mr.

[1] Edited by Clarence M. Weed, Durham, N. H.

[2] This is the original name, and the derivation from στέμμα is evident, but the form seems to be incorrect. A similar carelessness in derivation is that of the names "Craspedosomidæ" and "Chordeumidæ," which classical usage would compel us to write "Craspedosomatidæ" and "Chordeumatidæ."

[3] Journ. Linn. Soc. Zool., XXIV, p. 447.

[4] Zool. Erg. einer Reise in Niederl. Ost-Indian, Herausg. von Dr. Max Weber, p. 376. As this reference cites the former one (Journ. Linn. Soc., XXIV, p. 447) it would seem to be a later publication.

Pocock informed me that the collector of the Ceylon species reported that the animals were saltatory. This apparent jumping motion, is caused by vigorous wriggling of the body. At other times they crawl or run after the manner of other Diplopoda, but are more fleet. Strangely enough, one of several genera of Spirostreptidæ found in Liberia is also very fleet and has the habit of throwing itself by vigorous wriggling in the same way as Stemmatoiulus. In Liberia I collected three well-defined species, here referred to Stemmatoiulus, but noticed no differences in habitat or habits. All were found among fallen leaves and decaying vegetable debris in deep forests or other moist and deeply shaded localities, or rarely in heaps of rubbish in open places.

Structurally considered, these Liberian species show many characters or combinations unique among recent Diplopoda. It will not be possible to separate satisfactorily the ordinal, family, generic and specific characters in this group until the American and Indian forms are better known, and the following subordinal description will probably need modification when further investigation has been made.

STEMMATOIULOIDEA, new Suborder.

Body fusiform, distinctly compressed laterally.

Labrum tridentate, with a median tooth.

Eyes of one or two very large ocelli.

Mandibulary stipe with cardo distinct, subequal in size with the stipe.

Hypostoma present, large.

Mentum entire, very short.

Promentum broad, longer than the mentum.

Lingual laminæ distinct, very large, transversely striate; lingual lobes provided with sense-cones.

Median lobe well-developed, without styliform processes.

Segments not divided by a constriction into anterior and posterior subsegments; the suture inconspicuous or wanting; dorsally with a distinct median suture and four pairs of setiferous punctations; surface divided by longitudinally oblique impressed lines into narrow areas.

Repugnatorial pores present, subdorsal, located in the anterior part of the segments.

Pleuræ incompletely adnate or nearly free from the tergites.

Pedigerous laminæ all free, of two different shapes.

Legs eight-jointed, except the first two pairs.

Seminal opening of males through an unpaired two-jointed, external duct inserted behind the second pair of legs, which are greatly modified.

Both pairs of legs of seventh segment of males replaced by copulatory organs.

Segments of adults 40–50.

Among these characters some are especially noteworthy:

The ocelli are many times larger than those of other Diplopoda, and the small number should not be looked upon as an indication that any reduction or coalescence has taken place, such as sometimes occurs in cave or subterranean forms.

The lingual laminæ of males are as large and as long as the stipes of the gnathochilarium, and are transversely striate. To accommodate these large laminæ the prementum is greatly reduced, but in the female the prementum is larger and the laminæ correspondingly shortened.

The eight-jointed legs are quite different in form from those of any other group of Diplopoda. Seven joints is the number in the other suborders, although the second joint is always very short and in some case is nearly or quite obsolete. The second joint in Stemmatoiulus is also small, though larger than in any other Diplopod, and the additional joint is probably the result of an articulation in last tarsal joint which in other forms is undivided.

In males the second pair of legs is conspicuously reduced and transformed into a pair of hooks probably of use in copulation,

Behind this second pair of legs is inserted an attenuate, apparently two-jointed, external seminal duct which lies back between the coxæ of the third and fourth pairs of legs, which are medianly hollowed out to receive it, as the drawings show. No such structure has been found in other recent Diplopoda, but the Carboniferous Archipolypoda as described and figured by Scudder show a probably homologous feature described by Scudder as an "intromittent organ." The copulation of Stemmatoiulus has not been observed, but as the creatures have the usual copulatory legs on the seventh segment it seems more reasonable to suppose that in Stemmatoiulus, at least, the function of the structure in question is to convey the seminal matter to the copulatory organs.

The pleuræ are neither free after the manner of Glomeris and Siphonotus, nor coalesced and obsolete as in Iulus and Polydesmus, but are anteriorly more or less adnate to the scuta, and posteriorly separated by a deep incision. Compared with those of the Oniscomorpha and Colobognatha the pleuræ of Stemmatoiulus are very small, which suggests the possibility that the pleuræ of Iulus have been lost, and have not so completely disappeared by mere coalescence.

The segments are provided with eight setæ each, instead of six as in Craspedosomatidæ, and they rise from punctations instead of tubercles,

though in the Iuliform Craspedosomatidæ the setæ sometimes rise from punctations, e. g. Caseya. The last segment is rudimentary and has four conic processes like those of the last segment of Craspedosomatidæ. The appearance of setæ on the last segment in these diverse forms accords with the known fact of their great constancy in the other suborders in supporting the view that they are primitive characters and hence of great importance in classification and the estimation of affinities.

The repugnatorial pores are subdorsal, located in the anterior part of the segment and occur in an uninterrupted series from the fifth segment. The occurrence of setæ and pores on the same animal indicates that closer affinity may prove to be possible between the Craspedosomatidæ and Callipodidæ than would be indicated by arranging them in separate suborders.

This combination of characters indicates a wide divergence in developmental history from the other recent Diplopod types. This divergence is also indicated by the fact that the affinities of Stemmatoiulus are evidently with the carboniferous forms known as Xylobius. The segments of Xylobius, according to Scudder's diagrams, are divided into so-called "*frusta*" by longitudinal impressed lines not apparently comparable to the striæ of Iulidæ nor to the carinæ of Callipodidæ or Cambalidæ. Hence I have arranged Stemmatoiulus and Xylobius as representatives of suborders[5] under a new ordinal name, Monocheta, coördinate with the Oniscomorpha, Limacomorpha, Colobognatha and other groups noticed below. The comparative study of the Diplopoda necessary in examining the question of the proper systematic value of the characters presented by Stemmatoiulus has led me to look upon the Helminthomorpha of Pocock as a composite group, the different members of which are not necessarily more related to each other than to the Oniscomorpha or Limacomorpha.

An apparently satisfactory means of division into groups the members of which have more evident affinity among themselves, is to be found in the location of seminal opening and the structure of the external seminal ducts when present. Without known exception the characters drawn from these organs are accompanied by a definite complex of other features so that there appears to be ample ground for

[5] Suborder Xyloiuloidea, to contain the family Xyloiulidæ, genus Xyloiulus fossils from the Sigillarian stumps of Nova Scotia. Xylobius Dawson is preoccupied, and is replaced by Pyloiulus.

the claim that the proposed groups[6] are natural ones. The nature of the differences by which the Monocheta are maintained as distinct may be shown by briefly indicating the most important diagnostic features of the different orders with which they have been confused. Complete parallel descriptions are in preparation.

Order MEROCHETA.

Median lobe of gnathochilarium with styliform processes.

Seminal openings of males appearing as perforations of the coxæ of the second pair of legs.

Suborders Polydesmoidea, Craspedosomatoidea, Callipodoidea.

Order MONOCHETA.

As defined above. The affinities, as far as these can be indicated, seem to place this order between the Merocheta and the Diplocheta.

Suborders Stemmatoiuloidea, Xyloiuloidea.

Order DIPLOCHETA.

Seminal openings through paired ducts inserted at the base of the second legs.

Suborders Spirostreptoidea, Cambaloidea, Iuloidea.

Order ANOCHETA.

Labrum with a median sinus and an even number of teeth.

Segments 1–5 with one pair of legs each.

Seminal opening single, median, located at the base of the second legs; external seminal ducts entirely wanting.

Suborder Spiroboloidea.

Family STEMMATOIULIDÆ Pocock.

Stemmiulidæ Pocock, Journ. Linn. Soc., XXIV, p. 477.

Genus STEMMATOIULUS Gervais.

Stemmiulus Gervais, Ann. d. Soc. Entom. d. France; 2 series, II, 1844; 3 series, II, p. 70, Pl. V, fig. 11 (1844).

Type *St. bioculatus* (Gervais and Goudot) ibid.

Locality.—Columbia, temperate regions.

[6] Annals N. Y. Acad. Sci., Vol. IX, p. 8, 1895. There seems to be no good reason why the groups in question may not be looked upon as orders, as Mr. Pocock has proposed in the case of the Oniscomorpha and Limacomorpha. The characters which separate them are both fundamental and constant.

The type species had but a single ocellus on each side of the head, and may prove to represent a genus distinct from the forms with two ocelli. For the present, however we have no means of estimating the value of this character and the new Liberian species are provisionally described under Stemmatoiulus.[7]

Stemmatoiulus bellus sp. n.

Plates XLI, and XLII, figs. 1–31.

Body distinctly fusiform, especially narrowed caudad.

Vertex even, smooth and shining, very finely striate longitudinally, with a trace of a median suture; no hairs except one on each side rising from a punctation.

Clypeus even, smooth and shining with a few scattered piliferous punctations; immediately above the labrum with a row of peculiar clavate, decurved hairs.

Labrum with a rather deep emargination and three teeth separated by deep incisions.

Eyes of two very large ocelli, the superior of which is larger; a small punctiform sense-organ mesad from between the ocelli.

Antennæ clavate, the second and fifth joints longest.

Gnathochilarium and mandibles, see plates.

First segment semi-elliptical the inferior corners rounded; surface evenly convex, the margins not raised; two or three short striations near the posterior corners; surface apparently smooth and shining; under a lens of sufficient strength it is seen to be very finely striate longitudinally over the entire surface, as are all the other segments; no trace of a median line or suture; eight setæ rising from punctations near the posterior margin.

Subsequent segments with a very distinct median dorsal sulcus; on posterior segments this is gradually more deeply notched posteriorly; the whole surface of the segments is very finely and closely striate longitudinally; in addition to these there are numerous distinct oblique impressed line or striations, higher in front and at subequal distances apart, though closer together laterally than dorsally and closer on the posterior segments than on the anterior; there are about 26 of these oblique lines, 5–7 above the pores. The impressed lines are finely

[7] I have seen the types of *St. bioculatus* (Gervais and Goudot) and of *St. compressus* Karsch. The latter is a dried female in the Berlin Museum There seem to be six conic setiferous processes on the last segment; the pore is located in the third area from the median line; the striæ are wider apart than in the African animals; the legs shorter; the body strongly compressed, short and robust.

beaded or crossed by minute ridges, something after the manner in which the transverse sutures of certain Polydesmoidea are ornamented. The effect of these impressed striations is to give the body a peculiar satiny sheen. The striations do not appear on the dorsal surface of the first few segments, but come farther up gradually to about the tenth.

Repugnatorial pores beginning on the fifth segment; located subdorsally and on the anterior part of the segments, so far in front that they are frequently concealed by the posterior edges of the adjoining segment. The pores are below the second seta from the middle, though the setæ are near the posterior margin of the segment; the pores are usually just below one of the oblique lines which is then sinuate upward around the pores; sometimes the pore is midway between two lines which are then not sinuate, but are always wider apart than any other lines, for their whole length.

Setæ in four pairs; the lowest pair small and inconspicuous, but always present.

Last segment rudimentary, with four setiferous conic processes.

Anal valves not strongly convex, the margins not compressed or raised; surface moderately hirsute with hairs of different lengths, especially caudad.

Preanal scale nearly semicircular, with the two setæ usual in Diplopoda.

Pleuræ striate in the same manner as the scuta.

Pedigerous laminæ of two sorts, those of the anterior pair of legs of each segment subtrapezoidal, those of the posterior pairs with the posterior corners produced. The spiracles are large and distinct.

First pair of legs six-jointed in both sexes, the three distal joints fringed with long hairs.

Second legs of male modified into hooks; four joints are distinguishable, the two lower nearly coalesced. Second legs of female reduced, five-jointed, the joints fringed with long hairs, as are those of the first pair.

Legs 3–5 of males distinctly crassate, the others slender. The distal joints of the anterior male legs have peculiar stout spines or chitinous processes in addition to the usual and ordinary hairs.

Copulatory legs of male, see figures.

Color a dark though bright, horn-brown; a narrow yellow median stripe; a row of light (whitish) spots in which the pores are located. The dark color stops at the middle line of side, and below this the animal is colored a bright orange or light brownish-yellow; legs and

ventral surface pale yellowish or nearly white. Head and antennæ dark. Second and third segments bright yellow, and forming a conspicuous collar.

Length 25–30 mm., width 2·5 mm., dorso-ventral diameter 3 mm. Segments 48–50.

Locality: Not rare in Western Liberia; Monrovia, Muhlenburg Mission, and Mt. Coffee. I have examined about 40 mature specimens. The females seem to be somewhat more numerous than the males.

The above description may be taken as somewhat generic, at least for the Liberian species. In the remaining two only characters differing from those of *St. bellus* are given.

Stemmatoiulus pencillatus sp. n.

Plate XLIII, figs. 32–46.

Body slender, not so distinctly fusiform as in the last species.

Segments with setiferous punctations inconspicuous; dorsal suture and sulcus more distinct and notched posteriorly; the impressed lines more distinct and the surface of the segment between somewhat more convex than in *St. bellus*.

Second male legs with a pencil of long hairs rising from the third joint, where in *St. bellus* there is a cluster of shorter hairs. On the fourth joint is a pectinate row of curved spines in, *St. bellus* represented by a cluster at apex.

Legs 3–5 of males more strongly crassate than in *St. bellus*.

Copulatory legs quite distinct in form, see figures.

Colors in general similar to that of *St. bellus*, but not so bright, mottled horn-brown. Median stripe broader, but rather indistinct, reddish-brown; spots about the pores very indistinct, horn-color, lighter than the surrounding surface. The dark color ceases at about the middle of the side, but not very constantly or abruptly. Immediately below there may be a row of dull orange spots, or the whole lower lateral surface may be a mottled light horn-brown. Feet whitish, antennæ dark, except the last joint. Second and third segments not yellow, but rather darker than the others; the first segment is occasionally yellowish.

Length of male 19 mm., width, 1·25 mm.; female 22 mm. and 1·75 mm., there being a much more noticeable disparity in size than in the preceeding species. Segments 50–53.

Locality: A rare species in Western Liberia; Mt. Coffee and Muhlenburg Mission.

Stemmatoiulus calvus sp. n.

Plate XLIV, figs. 47–57.

Body smaller and less fusiform than in *St. bellus*, but more robust than in *St. pencillatus;* lateral compression not so strong.

Segments with the minute longitudinal striations less distinct than on *St. bellus;* the coarser striations less oblique and less distinct; the pores seem to be slightly more dorsal.

Second male legs almost without hairs on the two distal joints, which are also much more slender than in the two preceeding species.

Length 3–5 distinctly crassate, but less so than in the other Liberian species.

Copulatory legs of characteristic form, see figures. A notable difference is shown in the basal lamina of the anterior face. In both other species this is broad and distally emarginate; in *St. calvus* it runs out into an attenuate process.

Color: In life this species appears to be banded with black and white alternately, as the posterior part of each segment is subhyaline and appears white. In alcohol the color is dark horn-brown, nearly black, somewhat mottled; median dorsal line very narrow orange, sometimes nearly or quite obsolete. A row of lighter horn-brown spots along the pores and another similar row at an equal interval below; the dark color is not interrupted at the median line of side as in the other species, but extends down nearly to the pleural suture. Under surface, legs, and apical joint of antennæ whitish.

Length 22 mm., width 2 mm.; number of segments, 44–47.

Locality.—A rare species in Western Liberia. Found only in the region of the Mangrove Swamps in vicinity of Monrovia; I have collected a few specimens on Bushrod Island and along the Mesurado River, of which two are mature males.

A considerable quantity of young specimens were collected, but they are difficult of determination and have not been given much study. In young individuals of all the species the color is a uniform grayish. I have also collected forms congeneric with the Liberian at Sierra Leone and at Conakry, French Gambia, but no mature males were secured.

The drawings of the Liberian species here submitted are supposed to show, in addition to the specific characters, the apparent constancy of the more fundamental and important features on which the higher divisions have been based. On this account figures of the same structures have been repeated for each species, even when the specific differences were not important.—O. F. Cook.

Explanation of Plates.

Plate XLI.

Stemmatoiulus bellus.—Fig. 1. Gnathochilarium of male; 2. Part of same, more magnified; 3. Gnathochilarium of female; 4. Antenna of male; 5. First pair of legs of male, posterior view; 6. Second pair of male legs, anterior view; 7. Same, posterior view, showing also the external seminal duct; 8. One of the second male legs, lateral view, more magnified; 9. Same, posterior view; 10. Third leg of male, posterior view; 11. Fourth leg of male, posterior view; 12. Fifth leg of male, anterior view; 13. Sixth leg of male, anterior view; 14. Tenth leg of male, anterior view; 15. Male genitalia, anterior view; 16. Same, posterior view.

Plate XLII.

Stemmatoiulus bellus.—Figs. 17. Anterior pair of legs of a segment from the middle of the body, anterior view; 18. Posterior view of basal portion of same; 19. Posterior pair of legs from same segment; 20. First four segments, ventral face; 21. Lateral and ventral portion of a segment from the middle of the body, showing the pleural suture; 22. Mandible; 23. Head, lateral view, showing antennal socket, two large ocelli, mandibulary stipes and gnathochilarium; 24. Dorso-lateral part of a segment, showing the median line at the left, the sculpture, repugnatorial pores, and three setæ; 25. Last three segments, dorsal view; 26. Same, ventral view; 27. Same, lateral view; 28. First pair of legs of female, posterior view; 29. Second pair of legs of female, posterior view; 30. Third pair of legs of female, posterior view; 31. Fourth pair of legs of male, anterior view.

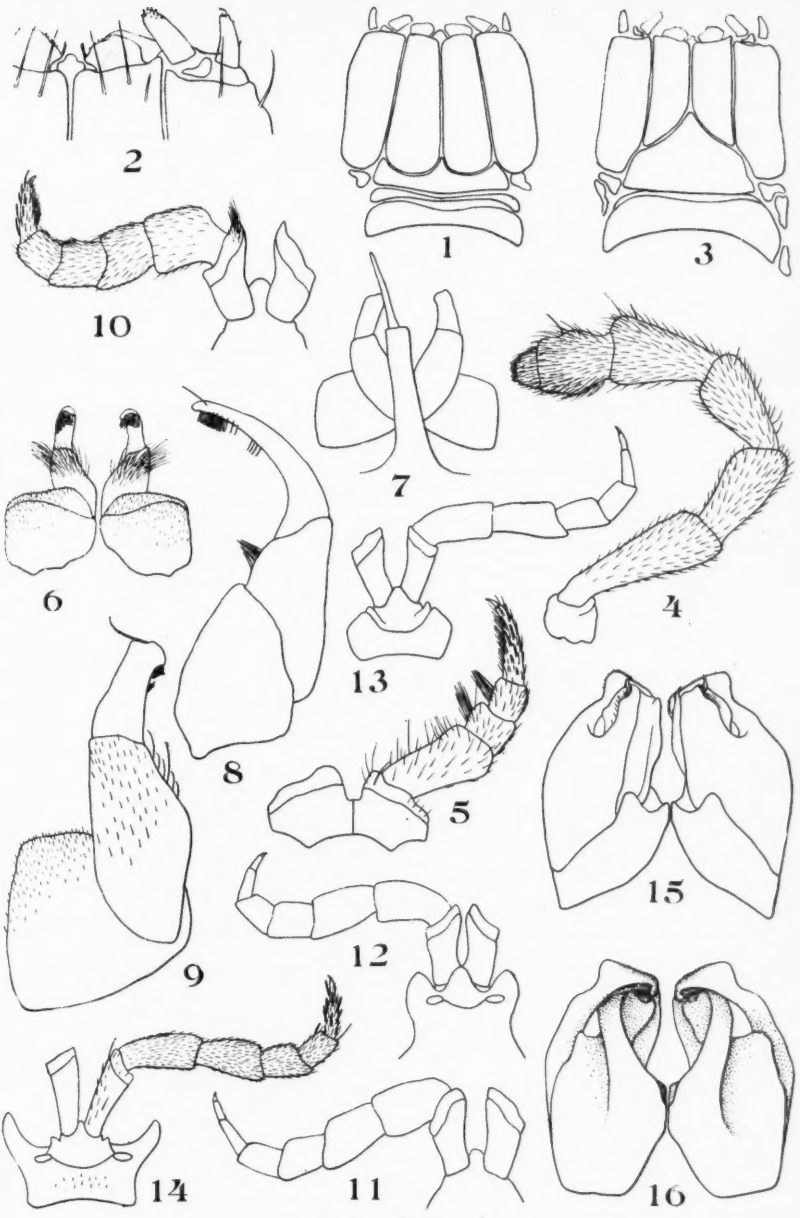
Plate XLIII.

Stemmatoiulus pencillatus.—Figs. 32. Antenna of male; 33. Gnathochilarium of male; 34. Leg of first pair of male; 35. Second male leg, anterior-lateral view; 36. Second pair of male legs, posterior view, showing also the exterior seminal duct; 37. Third pair of male legs, posterior view; 38. Apical joints of same, more magnified; 39. Fourth pair of male legs, basal joints, posterior view; 40. Fifth pair of male legs, anterior view; 41. Sixth male leg, anterior view; 42. Seventh male leg, anterior view; 43. Male genitalia, anterior view; 44. Same, posterior view; 45. Labrum, exterior view; 46. Same, interior view.

Plate XLIV.

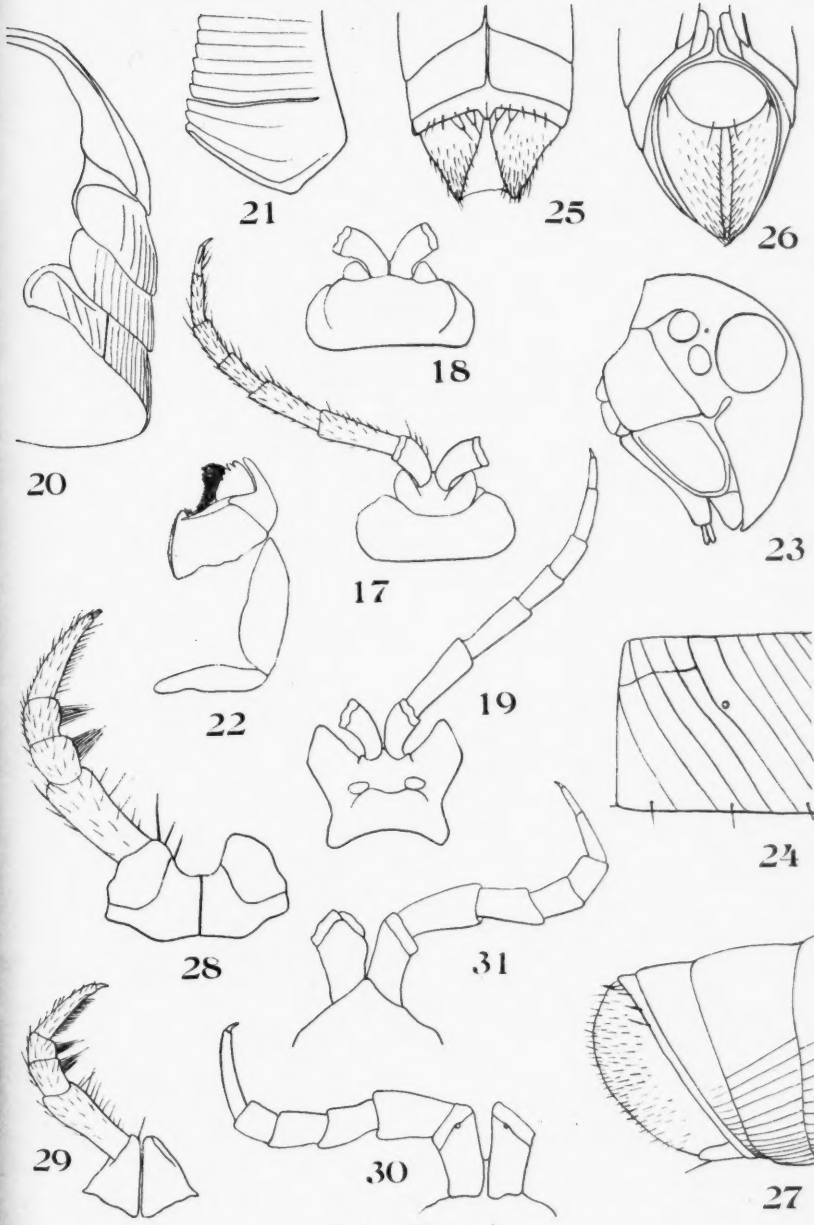
Stemmatoiulus calvus.—Figs. 47. Gnathochilarium of male; 48. Antenna; 49. First male leg; 50. Second male leg, anterior face; 51.

PLATE XLI.



Cook on Myriapoda.

PLATE XLII.



Cook on Myriapoda.

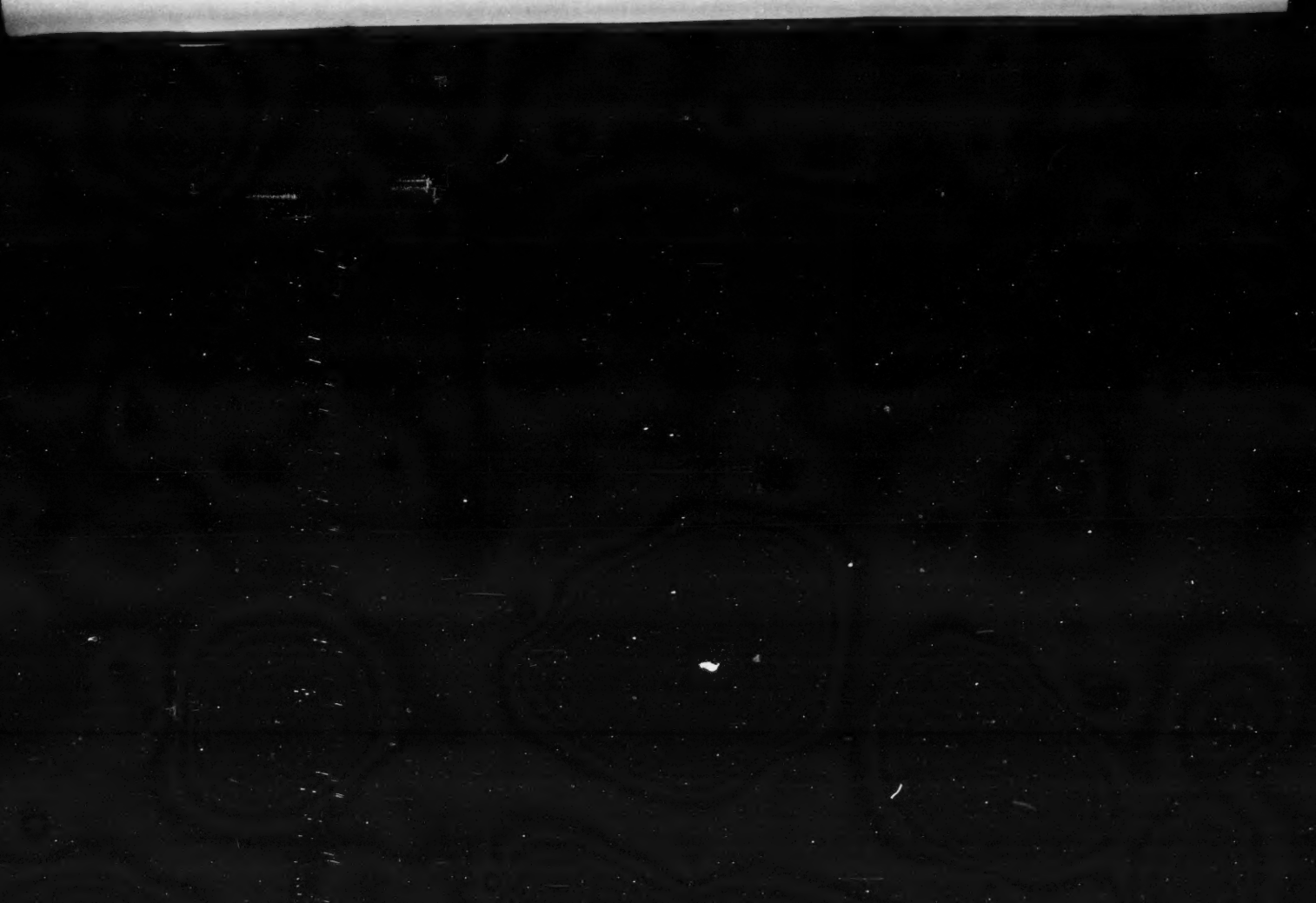
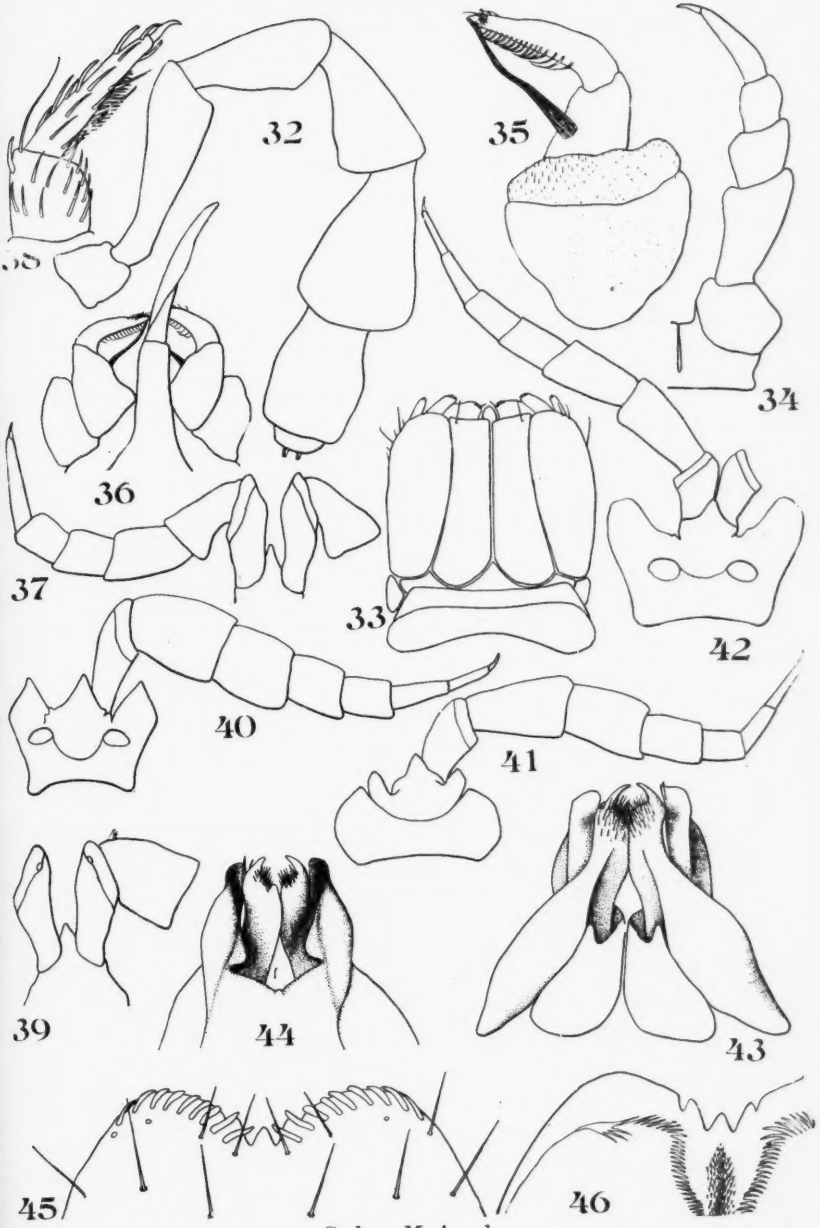
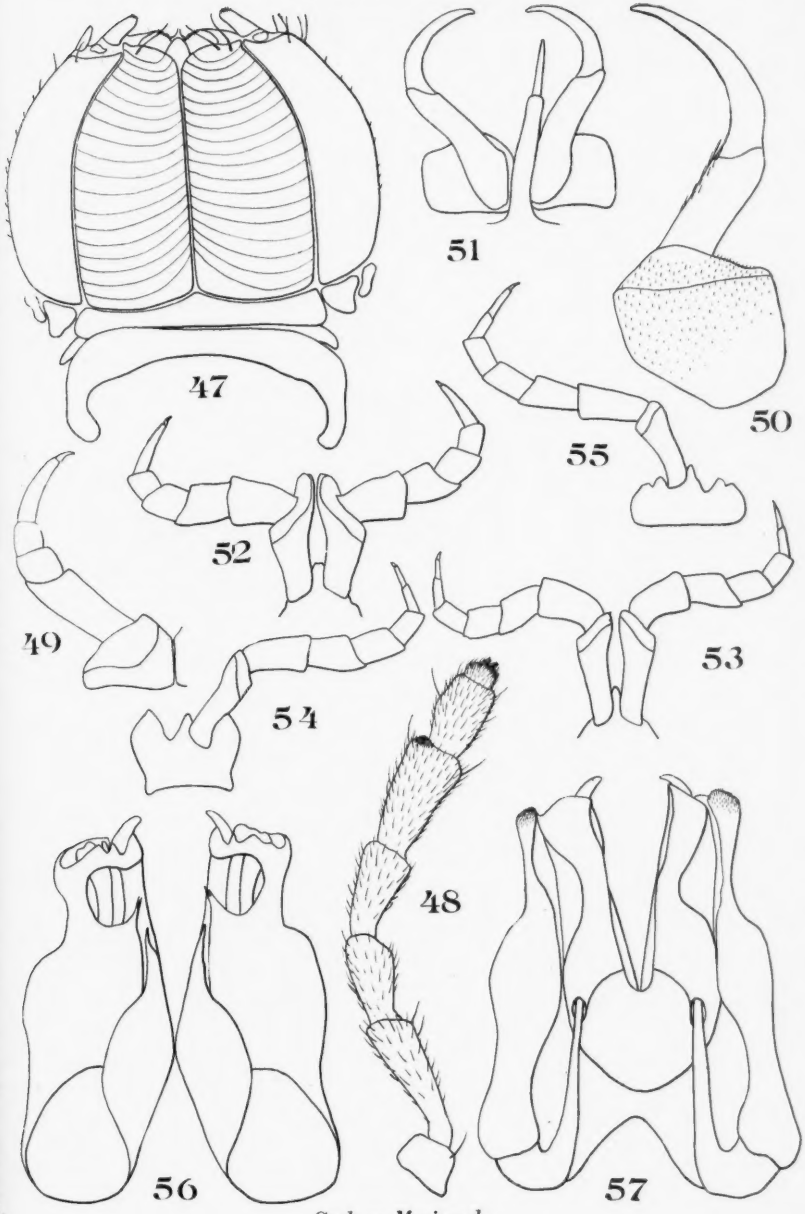


PLATE XLIII.



Cook on Myriapoda.

PLATE XLIV.



Cook on Myriapoda.

Second pair of male legs and external seminal duct, posterior view; 52; Third legs of male, posterior view; 53; Fourth legs of male, posterior view; 54, Fifth legs of male, posterior view; 55; Sixth legs of male, posterior view; 56. Male genitalia, anterior view; 57. Same, posterior view.

EMBRYOLOGY.[1]

Conjugation of the Brandling (continued from page 1027).—It is an error to suppose that there is any great accuracy of adjustment of ring to ring in this process of conjugation; there are no openings of one to be brought opposite to openings in the other but only the long girdle to be applied to the region of the sperm receptacles which open between the ninth and tenth and the tenth and eleventh rings. When the girdle envelopes this region, as seen in the two-constricted parts of the figure, the enlarged intermediate region with the openings of the male ducts may be drawn backwards or forwards without need of accurate coincidence with certain rings on the other worm.

Having hardened conjugating brandlings after killing in boiling water we may cut sections of the two and obtain some insight into the anatomical relations of various parts during, or at least at any given stage of the process of sexual interchange. In longitudinal median sections we find such conditions as are indicated in figure 2 which represents the true relative size and positions of the organs although small details are omitted and the organs are represented in a conventional way. We see the somewhat free head end of the upper worm then the constricted region, the long swollen region, the second constricted part and the head end of the lower worm.

Examining the upper worm from the head backward we see that in the first-eight rings the digestive tract has a large muscular and glandular thickening of its dorsal wall, that the brain lies in the cavity of the third ring while the nerve cord is shown ventrally just as in the normal worm at ordinary times. The ninth and tenth rings form a small swelling sharply cut off by very deep constrictions of the body wall from the regions in front and behind. In these two rings the diges-

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

tive tract is reduced to a more slender tubule with scarcely any lumen. The main bulk of this region is made up by the seminal receptacles two of which are shown as swollen bags full of fresh sperm. There are in all four such bags two opening between the 9th and 10th and two between the 10th and 11th; as indicated in this figure the openings of those bags are tubules that run out through the body wall on the dorsal side, not on the median line but some distance right and left.

Immediately after the region of the sperm receptacles follows the long enlargment that reaches from the 12th to 25th rings inclusive. Here the digestive tract enlarges as the soft-walled crop in the fifteenth and sixteenth rings and then narrows as the gizzard with very thick walls. Then from about the eighteenth ring the intestine runs back as a much distended tube full of liquid. The great accumulation of liquid in this swollen part of the body between the two constricted areas is a marked feature; the same congested state pertains to the dorsal blood vessel which is seen as a very thick tube dorsal to the intestine though in the constricted sperm-receptacle region it is reduced to a scarcely observable and collapsed state.

What gives this long intermediate region its excessive plumpness and distended appearance at the anterior end, where it seems to overhang the first constriction as seen in fig. 1, is the presence of the huge sperm vesicles, or as they are sometimes called testes, which are quite full of sperm is various stages of development. They are roughly indicated in figure 2 as large dorsal bags in the 12th to 16th rings. The body wall in this region is thin from distension and the diameter of the section is great from the presence of these seminal receptacles, the gorged intestine and blood vessel and the accumulated liquid of the body cavity.

The following region, from the 26th to 33rd rings is the girdle. It has a much thickened glandular wall and is contracted so that the section is small, the intestine, body cavity and blood-vessel all compressed. Just posterior to this the section enlarges and the organs take on a more normal state of expansion.

Looking now at the lower worm we find the anterior part essentially as in the first case but the next region is even more powerfully constricted so that these 9th and 10th rings make but a very small showing in the entire section.

One of the sperm receptacles is crowded back out of this region into the greatly enlarged part that follows. The constriction between the two regions has here taken place in the middle of the eleventh ring and the pressure has forced the posterior seminal receptacle of the small contracted region into the large mass that holds the seminal vesicles.

In the elongated region from the twelfth to the twenty-sixth rings the distension of the intestine and the great protuberance caused by the large crowded lobes of the seminal vesicles are even more pronounced than in the other worm.

The girdle is much contracted and constricted towards the ends in such a way that its thickened glandular wall extends both forward and backward beyond the constrictions into the neighboring regions.

From such sections we learn that the girdle and the region opposite it and containing the seminal receptacles are much contracted while the long intermediate region between the girdle is correspondingly distended. The ends of the girdle contractions are markedly constricted as deep annular grooves in which coagulated mucous serves as a cord to bind the two worms firmly together. The distended region is the one that contains the seminal vesicles full of sperm and the openings of their ducts on the fifth ring.

In a series of transverse sections of the anterior portions of two conjugating brandlings the condition of affairs at the contracted girdle region is especially striking. As shown in figure 5 one worm more than half envelopes the other. The upper part of the figure is the girdle region with its thick glandular and thinner muscular parts of the body-wall on the dorsal and lateral sides but with a much attenuated body-wall on the ventral side, which is pushed in so that the lateral parts hang down and form a deep trough for the reception of the other worm. The other worm, below in the figure, is so much contracted that the muscular part of its body wall is very thick and it is moreover thrown into folds that farther increase its extreme diminution in diameter. Its body cavity is very small and the digestive tract in it reduced to a minute tube as compared with the intestine in the other half of the section, in the girdle region of the other worm. In this shrivelled part of the worm enveloped by the girdle we see the ducts or outlets of two of the seminal receptacles, full of ripe sperm that stains deeply and is indicated in black.

This section passes nearly between the ninth and tenth or tenth and eleventh rings of the worm enclosed below by the girdle of the worm above which is cut across about the twenty-eighth to thirtieth ring.

The figure also indicates a cuticle like membrane passing from the girdle completely over the dorsal side of the other worm; this is hardened mucous that lies close to the worms and binds them together. At the same time there is a small space left between the epidermis and this mucous cuticle and in this we find ripe sperm, especially, as indicated in the figure, in the angles where the surfaces of the two worms separate.

As the sperm stains very darkly it may be easily recognized in sections. It is found in the sperm ducts of both worms as well as in the sperm receptacles, where some of it is not even now ripe. It is also seen issuing out of the openings of the sperm ducts onto the outside of the body in both animals. There it may be traced for some distance as it is held beneath the pseudo-cuticle of mucous that envelopes the worms. Especially abundant along lateral lines it rises up onto the dorsal side of the worm enclosed by the girdle and may there be seen collected about the openings of the seminal receptacles and traced into the short ducts of these organs to the mass that more or less fills up these four bags in all the conjugating brandlings as yet studied.

The anatomical evidence thus shows that in the conjugation of brandlings the girdles form grasping organs that envelope the part of the other worm containing the seminal receptacles and that a secretion, probably from the girdles, binds the two worms firmly together at these two regions. It also demonstrates that both worms pour out sperm onto the outside of the body and that this passes some distance backwards and not forwards along the sides of the worms and is finally taken into the seminal receptacles. We cannot, however, decide from these sections whether none of the sperm of one animal enters its own receptacles, but there is nothing to militate against the facts observed on the live Lumbricus, by Hering, that is the passing of two currents of sperm, each backward from its orifice to the girdle and so into the other animal and the sections indicate that no sperm passes forward to the animals own receptacles.

In the main the process of conjugation in the brandling as deduced from the anatomical relations of preserved pairs harmonizes exactly with the observations made upon the live Lumbricus and as we have seen by sectioning conjugating Lumbricus that the anatomical relations are almost the same as in the brandling we have little doubt that direct observation upon the brandling when they are made, will be largely a confirmation of Hering's account.

Yet the action of the girdle may be somewhat different since the dorsal opening of the seminal receptacles in the brandling as compared with the ventral opening in Lumbricus makes it difficult to understand how such movements of the girdle as described above by Hering can collect the sperm about the openings of the receptacles though they might bring it to the lateral positions shown in fig. 5. In the brandling even more than in the large Lumbricus we may suppose with Hering that same sucking action of the receptacles may be concerned in taking in the sperm.

We are probably not far wrong in concluding that conjugation is essentially the same in *Allolobophora fœtida* and *Lumbricus terrestris.*

In addition to filling the sperm receptacles of the other worm conjugation commonly leaves a trace in the form of the so-called spermatophores, or penis of Hering and older writers, which may here receive attention less from their intrinsic value than from their bearing, though it be slight, upon the important suggestion advanced by Professor Whitman namely that spermatophores might have been the original means of transferring sperm and only later superceded, in most animals, by localized organs for transmission. Though in the earthworms the foreign sperm is discharged from the receptacles when the eggs are laid and fertilizes them outside the body it might be supposed that these spermatophores in question were remnants of a formerly useful apparatus for putting sperm from one animal into the other, such as is found in some leeches. In the brandling, however, the indications seem rather to favor the idea that the spermatophore here is in a sense accidental and of no historical value so that it cannot be relied upon in extending the condition found amongst leeches to other groups, even if related.

When conjugating brandlings are separated we often find upon one or the other or both such spermatophores as are indicated in fig. 3. They are conspicuous white specks that soon turn yellow-brown though preserving a milk-white central elevation.

When pulled off from the epidermis, to which it adheres quite firmly at first, each is a homogeneous membrane or hardened secretion with a central cavity full of ripe sperm that moves when crushed out.

In a section of such a spermatophore attached between two rings we see, in figure 4, that it is very closely attached to the epidermis and that it ends abruptly, in fig. 3 it is seen to have a ragged edge and may also present outlying bits separately attached to the skin. The contained sperm lies in layered masses as if ejected into a stiffening jelly; moreover this mass is not entirely closed in as the section, fig. 4, would indicate but lies in a pit or pouch that opens at the top, in other sections, so that the sperm may be squeezed out in a fresh specimen. The spermatophore is thus a mass of sperm lying in an irregular cup of some tough secretion that is spread out on the skin and stuck to it.

Of 220 live brandlings taken at the conjugating season of the year 84 had spermatophores attached at about the 22nd ring of the body. Generally there are two sometimes but one, generally they are attached so as to cover the groove between two rings as in fig. 4 but often they are on the face of a ring as in fig. 3.

Of fifteen pairs taken in conjugation May 8th, 1892, five had spermatophores as follows: two symmetrically placed, between rings 22 and 23; one on the right side of the 23rd; two symmetrically placed on the 23rd; one on the left between the 23rd and 24th; two symmetrically placed on the 24th.

The region in which these bodies are found, the 22nd to 24th rings is opposite to the openings of the male organs of the other animal during conjugation, as already emphasized and indicated in figs. 1 and 2, and as the distance between the bodies, when there are two, is equal to that between the two male openings we are led to infer that these spermatophores are formed where the male openings are pressed against the other animal.

In serial transverse sections we find where the sperm is issuing from the male openings a condition of things such as is indicated in fig. 6. In the angle between the sides of the two worms just exterior to the closely applied ventral surfaces there is a considerable accumulation of sperm which is continuous with that issuing from the male opening. This extends backwards along the side of the worm that is ejecting it and is covered over by a dense, mucous, cuticle-like membrane as indicated in the figure. The glands near the male opening are evidently active and pouring out a dense secretion which fills up most of the space between the two worms and partly envelopes the large sperm mass. We have here what seems to be, with little doubt, a spermatophore in process of formation; the secretion of the glands about the male opening forms a dense mass adhering to the other worm and receiving in its substance a considerable collection of sperm as it issues forth. When the worms separate the secretion should adhere to the worm opposite to the male opening and leave in it a little mass of sperm; thus might arise spermatophores as are shown in fig. 3.

If the spermatophores are formed in this way as entangling of some sperm in a local secretion about the male opening and are stuck to the other worm they might still be of use in fertilizing the eggs of that worm when they pass into the egg capsule for the egg capsule would glide forward from the girdle over the region where the spermatophores are stuck and perhaps carry them off. But it is very doubtful if the spermatophores remain attached till the eggs are laid. Of twenty-two worms bearing spermatophores not one had them after forty-eight hours when kept in confinement, nor were any eggs laid in that time.

Though we regard the spermatophore as an accidental or at least useless structure as far as it has to do with any preservation of sperm we would not deny that the secretion about the male opening has a use whether sperm sticks in it or not.

Possibly this dense mass may serve to check the spreading of sperm in a forward direction and make more certain its passage backward towards the region where it can reach the receptacles of the other worm.

The balance of evidence seem to be that the spermatophores of the brandling, and by inference those of other earthworms too, are of no use after the process of conjugation is finished, that they do not serve to convey sperm and hence are not spermatophores at all in any proper sense of the word.—E. A. ANDREWS.

PSYCHOLOGY.[1]

Criminology.—In a series of articles on *Les Régles de la Méthode Sociologique*, recently contributed to the *Revue Philosophique* (May, June, July and Aug., 1894), Prof. Emile Durkheim, of Bordeaux, has taken occasion to advance a somewhat novel theory of crime and its relation to the normal social organism. This he restates and reaffirms in the May number, 1895, in reply to a rather intemperate attack made by M. G. Tarde in February. The whole controversy is of interest as showing how easily familiar facts assume a new and even paradoxical guise when put in ambiguous language.

Prof. Durkheim finds his point of departure in the impossibility of getting from the subjective or the teleological points of view any satisfactory definition of the concepts *normal* and *pathological*. The morbid is not necessarily painful *e. g.*, hysterical anæsthesia and, *vice-versa*, the painful is sometimes normal, *e. g.*, menstruation, parturition. The normal cannot be defined as that which is adapted to its environment, for it is not proved that every state of the organism must be adapted to some external state, and, in any case, we lack a criterion to judge between greater and less degrees of adaptation. Nor is the normal that which is fitted to survive, since, *e. g.*, infancy and old age are normal, and, on the other hand, many morbid states do not appreciably shorten life. There remains, then, only one suitable meaning which we can give these words. The normal is the general, the usual, the average. The abnormal, morbid or pathological is the exceptional and unusual. It follows then that the conception of a healthy organism is practically identical with that of the organism as such. Health will also be

[1] This department is edited by Dr. Wm. Romaine Newbold, University of Pennsylvania.

desirable, for the normal or average traits which constitute it are grouped together chiefly by reason of their common utility to the species.

The importance of the above analysis, Prof. Durkheim continues, will become evident if we apply it to a single problem. All criminologists are agreed that crime is a pathological phenomenon. Yet, in the light of the foregoing, the error of this view is at once apparent. Crime is found in all societies of all types, and is indissolubly connected with the conditions of social life; it must therefore be regarded as a normal phenomenon. By this admission we do not merely mean that it is inevittable, although regrettable; we mean "that it is a factor of the public health, an integral part of every healthy society." Good reasons can be given for this conclusion. In the first place, crime can never be abolished. It consists in the offence of certain collective sentiments If those sentiments could be made strong enough to suppress the present forms of crime, they would, by reason of their greater sensitiveness, take fresh offence at acts now regarded as venial, and crime would be as far from extinction as ever. In the second place, since it depends upon conditions which are essential to life, it must itself be regarded as advantageous. In the third place, this occasional clash of the individual with the collective sentiment of the community is an essential condition of progress. The abolition of crime would be the abolition of progress. "Thus we see the fundamental facts of criminology in a quite new aspect. Contrary to current notions, the criminal no longer appears a radically unsocial being, a parasitic element as it were, a foreign and unassimilable body introduced into the midst of society; he is a legitimate instrument of social life. Crime should no longer be conceived as an evil that cannot be contained within too narrow bounds; but, so far from congratulating ourselves when it chances to fall too noticeably below its usual level, we should feel confident that our apparant progress is accompanied by, and is even organically continuous with, some social disturbance." . . . . "Since crime is not morbid, its cure cannot be the end of punishment, and that end must be sought elsewhere." To these startling deductions Prof. Durkheim adds some even more startling reflections upon the practical advantages of this truly and only scientific method of investigation. No longer need human effort be wasted in the pursuit of fantastic and indefinable ideals. The desired and desirable end, that is, social health, is something definite and known; we need only labor to maintain the normal state of affairs, to reëstablish it if it is disturbed, to reconstruct its conditions if they tend to change.

To this argument M. Tarde replies by reaffirming the prevalent view that crime is hurtful to society, and therefore a menace to progress, contests Prof. Durkheim's attempt to exclude from the definition of the normal the teleological element and concludes, most unhappily, as I think, with a protest against the admission of "science," reason's offspring, as the supreme guide of life to the exclusion of "the heart, the soul, the imagination." To which Prof. Durkheim calmly replies by admitting all his opponent can say as to the evil effect of crime; his sole point is that crime is an inevitable outcome of the laws of life, must therefore be regarded as normal, and is both indirectly and directly advantageous, in spite of its disadvantages.

Although surrendering no one of his original arguments, the tone of this reply is very different from that of his first statement. The enthusiasm of the iconoclast has given way to the determination of one convinced of his point, although apparently anxious to overlook its practical consequences.

The fallacies in Prof. Durkheim's argument are evident enough, although M. Tarde fails to see them. They lie in the ambiguity of the words *normal* and *crime*. "Normal" properly means "conformable to type," or "conformable to the standard." The type is primarily determined by the average of instances, and has no direct reference to the end subserved. We may thus regard a given scrap of stone, a case of typhoid fever as normal, *i. e.*, as types of their kind, without any covert teleological reference. But, when, in any given class, conduciveness to a given end is a relatively constant feature, it necessarily becomes embedded in the type-concept and the latter becomes teleological. It would thus be impossible to define a normal knife without explicitly or implicitly including fitness for cutting as one of its elements. When the end subserved is generally advantageous, a tendency manifests itself to enforce upon individuals conformity to the type and the latter thus assumes to the consciousness of the community the form of a standard to which one *ought* to conform. Again, since in the realm of nature constant features are usually due to the operation of fixed laws, the normal in the first sense is frequently necessary. But the normal is not always necessary, as it is not necessary that a human adult be above three feet in height, although the normal adult is. The word "abnormal" is not the simple negative of "normal," but is properly the negative of its second sense only. "Morbid" and "pathological" are used in yet narrower sense. When we endeavor to discover the concept "normal" in the phenomena of life, we meet with a new difficulty. The phenomena of life are always manifested

by individuals, but their function is two-fold. At first glance it appears to be the preservation of the individual, but a closer examination shows that they can subserve that end only in so far as it conduces to the preservation of the race. Thus phenomena may be found which conduce to the preservation of the race, or which are absolutely in harmony with it, while endangering that of the individual. The words "morbid" and "pathological" primarily denote that which tends to the destruction of the individual; secondarily, they are used of that which tends to the destruction of the race. They are not antithetical to "normal" in its first sense of "typical," but in its second sense only. Their proper antithesis is "healthful."

A similar ambiguity lurks in the word *crime*. Prof. Durkheim would define it as an act which is repressed by the sense of the community. This is not its common meaning. As ordinarily used, it denotes an act which is not *condemned*, but *condemnable*; the latter word involves reference to a standard, and that standard may be defined in various ways. The standard which is more or less explicitly recognized by most of us who are accustomed to the biological way of thinking, is "conduciveness to preservation," and this is implicitly acknowledged by Prof. Durkheim himself.

If we follow his reasonings with these distinctions in mind, the paradoxical character of the conclusions vanishes. Let us quote his words and bring to view in italics the ambiguity of the thought:

"To class crime among the phenomena of normal sociology, *as we are justified in doing because it is found in every society* (*1st sense of "normal"*), is equivalent, *since that which is normal is also conducive to preservation* (*2d sense of "normal"*), to affirming that it is a factor of public health, an integral part of every sound society." P. 591.

Evidently this depends upon a confusion between the first and second uses of "normal."

The second argument would prove that crime is necessary and therefore useful. The paradox depends upon the double sense of "crime." If we remember that Prof. Durkheim means no more than individual transgression of the majority's will, the paradox vanishes. We may also admit that such transgression is occasionally useful. The question as to its necessity is more difficult. Prof. Durkheim conceives of progress as the resultant of two opposing factors, the tendency to innovation on the part of individuals, and the tendency of society to suppress innovations, hence those innovations only survive which are found to be advantageous. He tacitly assumes that the innovations of individuals must be as much disadvantageous as advantageous, and infers that any

increase in the intensity of the repressive factor must tend to the suppression of all forms of innovations alike, and hence must extinguish progress. For this conclusion I can see no warrant. The tendency of individuals to disadvantageous variation is not, in fact, proportioned to the tendency to advantageous, and as the latter gains ground upon the former, the necessity for stringent suppression on the part of the community diminishes. In ethical terms, with the moralization of the individual, laws and penalties become superfluous. With the increase in average intelligence also goes an increase in the intelligence with which the repressive instinct is exercised and a greater freedom in choice is allowed the individual than was found in earlier stages of development.

Thus Prof. Durkheim's startling paradox dissolves upon examination. Crime, in the narrower sense of the word, *i. e.*, conduct disadvantageous to the community, is not shown to be essential to the existence of variations in conduct which may prove advantageous to the community, since we have reason to believe that continuous decrease in the former is entirely compatible with continuous increase of the latter.

The Habits of Nestor.—Mr. Taylor White gives, in the last number of the *Zoologist*, an interesting account of the Kea or *Nestor notabilis*, the parroquet of New Zealand, which is so often cited as an example of a gramnivorous bird becoming, on occasion, carnivorous, and which is reputed to attack sheep and devour the delicate fat which envelops the kidneys. Mr. White lives in New Zealand, and can observe the bird close at hand.

According to him, the Kea subsists principally on lichens and not on fruits or grain, for it is found at some distance from the forest, among rocks and on bare ground. Like other animals unaccustomed to man, the Kea exhibits no fear at first sight. It allows itself to be approached, and Mr. White speaks of some of the birds playing about him, even becoming familiar enough to peck the buttons on his boots. Others would perch on his hand and allow themselves to be caressed. In captivity, they eat both bread and meat. Their powerful beaks enable them to break the bars of strong wooden cages.

As to the carnivorous habits of these birds, Mr. White speaks as follows: About the year 1861, sheep were introduced, and after some years it was noticed that a certain number of them died, and on the backs of these, behind the shoulder, in the neighborhood of the kidneys, was found a peculiar wound. About this time it was discovered that the Kea was the enemy of the sheep. In selecting a victim the

Kea prefers an animal with long fleece to which it can cling. It would seem, moreover, that the bird is after the fat rather than the flesh. A Kea has never been seen on a dead body, and the probabilities are that it also feeds on the blood. The various stories told of the Kea are then true in part—it does attack sheep. But it is naturally carnivorous, for, in addition to fruits and grains, it feeds on insects. It has, then, not changed its régime in adding mutton to its ménu; it has simply extended its depredations. Revue Scientif., Aug., 1895, p. 248.)

ANTHROPOLOGY.[1]

A preliminary examination of aboriginal remains near Pine Island, Marco, West Florida.—The significance of Colonel Durnford's able and interesting communication to the AMERICAN NATURALIST for November, 1895, descriptive of his discoveries in South West Florida last Spring, may gain force, it is thought by the courteous Editor of this Department, if I add a few comments in regard to my own later observations in the same field, and in regard to the relation this find seems to bear to Eastern American Archeology in general.

It was my good fortune to be under the care of Doctor William Pepper and at the Hospital of the University of Pennsylvania when Colonel Durnford called at the Museum of the University and exhibited a few of his valuable specimens to its Director, Mr. Stewart Culin. It was also my good fortune both to meet Colonel Durnford and see his specimens at the time, and to receive from him then a full account of, and later, a series of detailed notes upon, his exploration.

From these communications and from examination of the articles he brought, I inferred that probably Colonel Durnford had investigated not an isolated place of the sort he so well describes, but a typical deposit such as might, by further search, be discovered in connection with other shell settlements in the same region. I therefore did not hesitate to pronounce this find of his one of the most important yet made on our southern coasts, and with a view to ascertaining more relative to its nature and to learning whether my inference in regard to its typical character was tenable or not, I gladly seized the opportunity afforded by the suggestion of Doctor Pepper, (whose views coincided with mine) that I extend a health-trip in the South, to the scenes of Colonel Durn-

[1] The department is edited by Henry C. Mercer, University of Penna, Phila.

ford's excavation, and, in the interest of the Archæological Association of the University of Pennsylvania, make examinations and, so far as might be collections there.

On reaching Florida, I found that it was impracticable to proceed beyond Punta Gorda, directly to the place Colonel Durnford and Mr. Wilkins had excavated. Procuring at this place a little sloop and two men, I therefore followed a somewhat round about course, exploring the greater number of keys or little islands lying along the way thence southward to the point in question, namely Collier's, near Marco. At the first key examined, some fifteen miles south of Punta Gorda, I found to my astonishment, that all its heights had resulted from artificial accumulations of shells, not irregularly piled up, like mere refuse heaps, but more or less structurally and regularly reared on a shallow reef in relatively shoal waters, to serve apparently as the core or central foundation of a village of enormous extent. These heights were fringed interruptedly by lower platforms and long, out-reaching winrows, so to say, of additional shell accumulations, some several feet high, others scarcely elevated above the level of high tide. Penetrating portions alike of these low shell embankments and of the central tumuli or cores, were openings long, narrow, and measurably straight through which the waters of the bay still to some extent ebbed and flowed. When seen from the highest points (for every portion of the key was covered with a tangled jungle of trees, vines and tropical plants, agaves and cacti, and when looked at from below was hidden by the dark, dense margin of mangoes) these openings seemed all to tend toward some central point or points; and on descending and following one of them I was led into a veritable water-plaza around which clustered the gigantic mounds of shell—each set of them between its channel-like openings. I then realized that this central space—which had an irregular extent of more than an acre—was the filled up basin of a shallow lake formed rather by the rearing of structures around it than by other artificial means, and now filled to high tide level by washings from these heights and by growths of aquatic plants. I further realized that the openings leading into this place were actual canals, preserved or kept clear between the shell mounds or platforms, etc., for the passage in and out of the canoes of the dwellers on and around the heights. An examination of the sides of the highest of the central shell mounds or cores surrounding this water-plaza or lake court, revealed ere long a fairly well preserved road-way leading up to near the summit of the mound, and with eyes thus opened, I soon found other, though less distinct roadways or trails on the shell slopes, leading up to lesser heights around. Following

these trails down to what was once the water's edge of the lake (which was even now so marshy that I could not excavate it with so limited a force) I found more than a hundred of the typical pierced busycon shells or conchas, such as had once (I later determined) served as the armatures or heads of hammers, clubs, picks, hoes and chisels or celts, etc., as was even then manifest to me in the various forms (pecked or ground) of their more tapering portions or whorl ends.[1] Thus I was at once convinced that this was another such place,—shell heaps, canals, central lagoon and all, as Colonel Durnford had described, yet on a scale so vast that I could scarcely believe it to have been artificial, wholly the work of human hands. What I have here described was more or less typical of no fewer than eleven others of these shell settlements later examined on various keys or on out-lying reefs of Pine Island, and the mainland below Punta Rassa. In the lagoon of one of the lower keys (off Pine Island), I was able to excavate sufficiently to determine that it too, contained the remains of objects of arts as was evidenced by a wattling plummet, a hammer stone (rare indeed in those parts where shell and bone seem to have replaced to a great extent the stone so common in other ancient camp sites) and a busycon shell pick *still mounted on its original handle of mango wood!* With this find I was convinced of the typical nature of the original Collier muck-bed as described in Colonel Durnford's notes, even ere I saw it, and the discovery here, and later in the edge of one of the great canals of the contiguous island, of the remains of pile work, suggested that these great shell settlements had been surrounded inside and out by post-supported platforms, from which alike implements, etc., now found in the mud as described by Colonel Durnford, and the shell rows or heaps alongside, which I have designated winrows, had been dropped. This, eked out by many later observations, solved the problem of the origin, as well as of the structural character of these great shell settlements. On reaching Collier's, I was most courteously received by Mr. and Mrs. Collier. Excavations alongside the diggings of Mr. Wilkins and Colonel Durnford, and still further in toward the center and one side of the muck bed, although made under water mostly (for the rainy season had set in) revealed within the few hours I could devote to the work other relics of the kind Colonel Durnford has described—net-pins, seine-

[1] I find, and it gives me pleasure to state here that in some of his earliest admirable communications to this Magazine relative to the Mounds of St. John's River, Florida, Mr. Clarence Moore arrives at almost identical conclusions regarding the uses of these pierced shells, and that my later finds in the mucks beds of old lagoons on Demorest's key and at Collier's fully confirm these conclusions.

stays, small fragments of netting, and the like, as well as rope made of palmetto and agave fibre, burnt thatch, a long and beautifully finished spar or post, fragments of a burnt mud hearth and of pottery, some highly finished, wattling plummets and sinkers, two beautifully shaped fish clubs, five mounted busycon shells, one of which was edged to serve as a celt, several of the shell funnels (which proved to have been mounted on handles as spoons) many necklace pendants, gourds, seeds, etc., etc. Some of the art remains found here and on the surrounding low, but very extensive shell mounds, as well as at other settlements, strongly indicated, as did skulls later dug from a shell burial place to the northward on Sanybal Island, a far southern origin of the builders of these works, at least of the oldest of them. Moreover, the study of these shell settlements and of their art remains, has been found by me to have a most important and explicit bearing on the archeology of at least the Mississippi and contiguous regions, in other words on the Mound Builder question; points which it is believed the expedition I am hoping soon to conduct to Florida under the joint auspices of the University Association and the Bureau of American Ethnology will clear up and to some extent demonstrate or establish. But even if these indications of a hasty reconnissance be not all borne out by more careful examination of the field, still, this find of Colonel Durnford's seems to have been typical, to relate at least to a hitherto unthought of phase of aboriginal life, to relate also to a period indefinitely antedating the time of Columbian Discovery, and hence giving us, as have the cliff dwellings—so opposite in character—well preserved remains of the perishable work of prehistoric stone-age (or, in this case, shell-age) men, and is thus the most important of Archeologic finds recently brought to notice. The Archeological Association of the University of Pennsylvania is therefore to be congratulated on the uuique opportunity far research in a comparatively new field which Colonel Durnford's scientific disinterestedness and generosity has made possible.—Frank Hamilton Cushing.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The National Academy of Sciences.—A scientific session of the Academy was held at Philadelphia, in the Laboratory of Hygiene of the University of Pennsylvania, beginning Tuesday, October 29, 1895, at 11 o'clock A. M. and continuing through the following day. The papers presented were as follows:

(Oct. 29th) On the Paleozoic Reptilian Order of the Cotylosauria, E. D. Cope; On a New Variable of Peculiar Character, S. C. Chandler; On a Bone Cave at Port Kennedy, Pa., E. D. Cope; On Borings through the Coral Reef in Florida, A. Agassiz; On the Alkali Uranates, Wolcott Gibbs; (Oct. 30th) The Olindiadae, W. K. Brooks; The New Campanularian Medusae (read by title), W. K. Brooks; The Filar Anemometer, Carl Barus; The Counter-twisted Curl Aneroid, Carl Barus; On the Broadening of Spectral Lines by Temperature and Pressure; A. A. Michelson; On the Asteroids (read by title), A. Hall; The Early Segregation of Freshwater Types, Th. Gill.

Boston Society of Natural History.—Nov. 6, 1895.—The following paper was read: Prof. George Lincoln Goodale, "Some Peculiarities of Australasian Vegetation." Illustrated by stereopticon views of Australia and New Zealand.

November 20.—The following paper was read: Dr. J. Walter Fewkes, "Some Newly Discovered Cliff Ruins in Arizona. Stereopticon views were shown.—SAMUEL HENSHAW, *Secretary.*

American Philosophical Society.—November 15, 1895.—Prof. Cope read a paper "On the Ancestral Type of Amniote Vertebrata." Dr. Brinton presented a new vocabulary from South America, with remarks. Mr. H. C. Mercer made observations on Indian work in the Wyandotte Cave, Indiana.

The Biological Society of Washington.—October 19.—The following communications were made: S. D. Judd, "The Food of the Catbird, Thrushes and Wrens;" L. O. Howard, "An Enemy of the Hellgramite Fly;" W. H. Dall, "Exhibition of the Remains of the Mammoth;" C. Wardell Stiles, "The Rudolph Leuckart Memorial;" "The Third International Zoological Congress;" C. Hart Merriam, "North American Shrews."

November 5.—The following communications were made: F. V. Coville, "The Botanical Explorations of Thomas Coulter in Mexico and California;" William Palmer, "Albinistic Birds' Feet;" F. A. Lucas, "The Extinct Gigantic Birds of Patagonia."

November 16.—The following communications were made: Barton W. Evermann, "The Fishes of the Missouri River Basin;" Frank Baker, "Nomenclature of Nerve Cells;" Edw. L. Greene, "Some Fundamentals of Nomenclature."—FREDERIC A. LUCAS, *Secretary.*

SCIENTIFIC NEWS.

Bibliographical Reform.—At the Baltimore meeting of the American Society of Naturalists (Dec., 1894), a committee was appointed to consider Dr. H. H. Field's plans for bibliographical reform, the committee to report in print. That committee would report as follows:

Dr. H. H. Field, in view of the well-known imperfections and shortcomings of all existing records of zoological literature, has formulated plans which will give the zoological world an approximately complete index of all literature as promptly as possible. This record will be issued in the form of bulletins, each number of which will be distributed as soon as sufficient material has been acumulated to make a "signature." The same bulletin will also be issued printed only on one side of the page to allow for cutting up for special bibliographies. Lastly, the separate titles will be issued upon cards of the standard "index" size. Each title will be followed by a few words giving the subject and scope of the article, when this is not sufficiently indicated by the title, while the cards will have, in addition, catch numbers, so that any library assistant can readily incorporate them in the card catalogue.

The plan contemplates a union of existing bibliographies with this one. In the case of the Naples Jahresbericht, this will consist in co-operation, this series continuing as the yearly morphological analysis of the bibliography. It is to be hoped that the Zoological Record will co-operate in a similar way, devoting itself to the systematic side, and, by aid of the new facilities of co-operation, increase its present usefulness to students. Arrangements have now progressed so far that it seems probable that the records of literature in the Zoologischer and Anatomischer Anzeigers will be merged in the new scheme, and, it is hoped, that the one in the Archiv für Naturgeschichte will take the same course. If sufficient encouragement be given, it is proposed to include physiology in the scope of the new plan. The net gain will be fewer bibliographies, wider scope, nearer approximation to completeness, and more prompt publication.

The central office of the work will be established at Zürich, Switzerland, and it may be said that the cantonal government has already appropriated 2000 francs annually to its support, and will supply suitable quarters for its work. France has promised a similar sum, and

aid is expected from Germany, from the International Congress of Zoologists, and from the British Association for the Advancement of Science. Committees have been appointed in France, Germany and Russia to co-operate in making the record as complete as possible. Lastly, publishers stand ready to undertake the publications of the bulletins, cards, etc., without expense to the central office, since the sales are estimated to fully cover all cost of manufacture. The only matter unprovided for is that of preparing the record for the printer, and this is already so far provided for that if America can give $500, the beginning of the work with the year 1896 can be assured.

Your committee, having examined the matter in detail, would therefore report that they regard the plan as one worthy the fullest support of the American scientific world. They recommend it as worthy of financial support, and would urge all publishers and publishing institutions to send all periodicals and other works, or, in the case of books, at least the correct title and a summary of contents prepared by the author, promptly to the central bureau. They would finally recommend the appointment of a permanent committee of ten, to co-operate with similar committees in other countries in forwarding the movement.

Signed: SAMUEL H. SCUDDER,
H. P. BOWDITCH,
HENRY F. OSBORN,
E. A. ANDREWS,
J. S. KINGSLEY,
Committee.

In this connection it is well to state that the funds desired from America have been obtained: $250 from the Elizabeth Thompson fund, $250 from the American Association for the Advancement of Science, and $50 from the American Society of Microscopists. Arrangements have been concluded for the publication, by Englemann, of Leipzig, of a "Bibliographica Zoologica," as a continuation of the "Litteratur" of the Zoologischer Anzeiger, and by Fischer of Jena, of a "Bibliographica Anatomica" to contain the morphological titles. The price for the first will be 15 marks a year, that of the Anatomica has not yet been fixed. Cards containing the titles will be issued at from $2.00 to $3.00, according to the number taken. Arrangements are now in progress for the inclusion of physiology in the plan, and steps have already been taken looking to the later incorporation of botanical literature.

Botanical readers will be pleased to hear that another part of Gray's Synoptical Flora of North America, beginning with Ranunculaceæ, is

now in press. Every encouragement should be given for the completion of this magnificent work.

Dr. J. P. Lotsy, formerly at Johns Hopkins University, has accepted a position with Dr. Treub, at Buitensorg, Java. It is said that the Macmillans will shortly issue an important work by him on the Morphology of Reproduction in Cryptogams.

Dr. James Ellis Humphrey will be instructor in Botany at Johns Hopkins the coming year. It is much to be regretted that this great university cannot see its way clear to the founding of a chair of Botany.

W. T. Swingle, of the Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture, has secured leave of absence, and will spend a year or two at German Universities. He goes first to Strasburger at Bonn, and will subsequently study with Göbel at Munich.

President and Mrs. Fairchild, of the State Agriculture College, Manhattan, Kansas, spent the summer travelling in Great Britain and on the Continent. Mrs. Kedzie accompanied them.

David G. Fairchild, formerly of the Division of Vegetable Physiology and Pathology, in the U. S. Department of Agriculture, has spent the last two years studying botany at various European centers—Naples, Breslau, Berlin, Münster. He is now studying fungi with Brefeld, and contemplates spending the winter at the great tropical botanic garden at Buitensorg in Java.

During the summer there were several changes in the personelle of the Division of Animal Pathology, in the Bureau of Animal Industry, U. S. Department of Agriculture, Dr. Theobald Smith, for a long time Chief of Division and widely known on account of his bacteriological researches, has become Bacteriologist to the Massachusetts State Board of Health and Lecturer at Harvard; Dr. V. A. Moore takes his place, and Dr. P. A. Fish, of Cornell Univ., becomes Dr. Moore's assistant.

Dr. C. W. Stiles, of the Bureau of Animal Industry, U. S. Department of Agriculture, has returned from a two months trip to Europe, made partly for the sake of attending the International Zoological Congress at Leiden.

Dr. Volney M. Spalding has resumed his duties as Professor of Botany in the University of Michigan, having recently returned from a two years' sojourn at German Universities, most of which time was spent with Pfeffer in Leipsic, at the British Museum, and with Brefeld in Münster.

Dr. Lucien M. Underwood has been called to the chair of Botany in the Agricultural and Mechanical College at Auburn, Alabama.

Dr. Engler, of Berlin, in conjunction with other distinguished botanists, has, in preparation, a new edition of Grisebach's famous treatise, *Die Vegetation der Erde*, which has been out of print some time. Mr. Th. Holm, of the Division of Vegetable Physiology and Pathology in the U. S. Department of Agriculture, has been asked to contribute the portion on North American Gramineæ and Cyperaceæ.

Mr. F. S. Earle, of Ocean Springs, Miss., has been appointed Assistant in the Division of Vegetable Physiology and Pathology in the U. S. Department of Agriculture, Vice Joseph F. James, resigned. Mr. Earle will have charge of the herbarium.

Mr. O. F. Cook is contemplating a third trip to the west coast of Africa. Mrs. Cook will accompany him. The next volume of the Transactions of the New York Academy of Science will contain an important systematic paper on Myriapods, from his pen.

The Entomological Society of Washington will devote the next number of its Proceedings to a memorial of Prof. C. V. Riley, who was the founder of the Society and always an active member.

The Australian Museum, at Sydney, still suffers from small appropriations by Parliament, and during the year 1894 it was working with a reduced staff and with practically no money for increase or publication. Dr. Ramsay, owing to ill-heatlh, has resigned his position as Curator after 20 years' service, but still retains a connection with the museum. Mr. Robert Etheridge, Jr., has been appointed as his successor. The total income for the year 1895 was about £6,000, and 120,000 persons visited the museum during the year, 34,000 of these coming on Sundays. Among the most interesting additions to the museum were a number of relics of Capt. Cook, the list of which would seem to indicate that this antipodial museum has about as large a collection of specimens collected by Capt. Cook and of memorials of him as has the museum at Oxford. The museum has also received a considerable collection of aboriginal pottery from Arkansas.

Dr. A. I. Vernenil, the well-known anatomist and surgeon, of Paris, died June 12.

Dr. A. Froriep has been made Ordinary Professor of Anatomy, at Tübingen.

Dr. W. C. Williamson, the botanist and paleobotanist of Owens College, Manchester, England, died June 23, aged 79.

Dr. J. Strahl, of Marburg, has been appointed Ordinary Professor of Anatomy, in Giessen.

The American Association for the Advancement of Science appropriated $250, and the American Society of Microscopists $25.00 towards Dr. Field's Bibliographical Bureau.

Dr. Karl Müller, of Berlin, goes as Professor of Technical Botany to the Technical School of Carlottenburg.

Dr. N. V. Ussing becomes Professor of Mineralogy in the University of Copenhagen, in place of Dr. von Johnstrup.

George Murray has been appointed Custodian of Botany in the British Museum, in place of Dr. Carruthers.

Dr. L. Plate is Privat-docent in Zoology in the University of Berlin.

Dr. Max Verworn has been appointed Extraordinary Professor of Physiology in Jena.

Dr. Albert Günther has retired from his position as Director of the Zoological Department of the British Museum, having reached the age-limit of the British Civil Service.

Count Angelo Manzoni, geologist and paleontologist, died in Ravenna, Italy, July 14, 1895.

Dr. W. Roux, of Innsbruck, goes to the University of Halle as Professor of Anatomy.

Sir John Tomes, well-known for his researches on the teeth, is dead at the age of 80 years.

Dr. E. Ihne has been appointed Professor of Botany in the Technical School at Darmstadt.

Rev. J. G. Morris for many years recognized as an eminent student of American Lepidoptera died at his home near Baltimore, October 10. Dr. Morris was born in 1803 and has long been considered one of the fathers of American entomology. His catalogue of the Lepidoptera published in 1860 by the Smithsonian Institution and his Synopsis of Diurnal and Crepuscular Lepidoptera are the publications by which he was best known to entomologists.

Dr. Albert E. Foote, of Philadelphia, died recently in Atlanta, Georgia. Dr. Foote was born in Hamilton, N. Y., Feb. 6, 1846. After graduating at Cortland Academy, Homer, N. Y., he entered the class of 1867 in the University of the State of Michigan, where he took the

degree of Doctor of Medicine. After some time spent as an instructor at Ann Arbor, he was appointed Assistant Professor of Chemistry and Mineralogy in the Iowa State College.

In 1875, Dr. Foote removed to Philadelphia. He was a life member of the Academy of Natural Sciences, of the New York Lyceum of Natural History, and of the American Association for the Advancement of Science. Dr. Foote's extended travels, both in this country and in Europe, made him particularly well known in scientific circles. His chief interest was in mineralogy.

He was well known as one of the few professional dealers in objects of nature in the United States, and he made a financial success of it, leaving a competency to his family. As an antiquarian repository of works on natural history, Dr. Foote's establishment is without a rival in America.

EDITOR'S TABLE.

—Some cultivators of the sciences occasionally complain that the meetings of scientific bodies are not well attended, and that they read papers to too many empty benches. Moreover, even when they have a scientific audience they allege that very few of those present understand what they have to say. And they speculate on measures to be adopted to remedy this state of affairs.

As the scientific investigator acquires years and experience, he recognizes that in the present state of human society he has no right to expect that the situation can be very different. The number of serious cultivators of science in any community is not large, and the number of men engaged in original research in any given field is still smaller. Like the landed aristocracy of the old nations, the producers in each department of science are well scattered over a country, and it is only on national occasions that they gather in any considerable force. The situation as to the audiences who assemble to listen to papers of original value in pure science is therefore not likely to change for some years. In fact, the size of audiences may be set down as inversely as the rationality, and directly as the emotionality of the matter set before them. Such is the present state of the civilized nations of the earth, and it is not peculiar to any one of them.

Most of the large cities of the United States have an "Academy of Sciences," or its equivalent, and it is largely with reference to the prosperity of those bodies that discussions such as we have referred to above is heard. Many of the members want them to be what they call popular, which, in its best sense, means that they wish for large audiences at the meetings. Now, if what we have said above is true, this object cannot be attained, unless the Academy abandons its real object, the advancement of scientific knowledge by original research. This is the primary object of Academies of Science in all countries, and if they neglect it, they lose their identity, since the facilities for the distribution of knowledge are everywhere relatively abundant. When the Academy of Science becomes a distributor of knowledge only, it abandons its important proper function, and becomes comparatively a nonentity. Let us hope that Academies of Science in America will not follow the course of the Academies of Music, which are, in Europe, educational and critical, in America, mere theaters.

The measures adopted by Academies of Science in the United States to make themselves popular and therefore "successful," are often highly amusing. The usual method is to elect some man president who is rich but unknown to science; since, in the minds of some people, money is the source of the sciences and the arts. Men of the same type are also often elected to other responsible positions in these societies for similar reasons. We have watched this mode of attacking the problem for many years, and have never known it to be successful. In the case of the Philadelphia Academy, it did, on one occasion, entail a loss of over $12,000 cash capital to the Society. In fact, the reasons why this method should not prove successful are not far to seek. The only way to make it successful would be to have a bill of sale of the office legally executed, so that the sum agreed on could be collected by process of law in case of failure to produce the "consideration" after the election. This the business world understands, whereas it does not perceive the cash value of original research. In fact, the election of an outsider to rule over them by a body of experts for a supposed financial equivalent, is a proceeding not calculated to excite the respect of a rich man or any other kind of man.

A society is, however, fortunate if it escapes without more serious injury than a financial disappointment. Men not habituated to the ways and means of research frequently apply nostrums which do more harm than good, and bring the society into deserved contempt. Thus in one city the President, who was of the type mentioned, succeeded in incorporating into the society a body of photographers, with the result

of simply developing the photographic society. The men by whom the original society was known to the world were locally quite lost sight of. In another city a number of local amateur astronomical clubs were taken into the Academy. These consisted of ladies and gentlemen whose devotion to science consisted in viewing the stars in each others pleasant society. Another Academy adopted popular lectures as a device for filling empty benches. The selection of the lectures being in the hands of incompetent officers, cranky and ignorant persons, and those who had apparatus to sell, occupied the time of the Academy, to the great scandal of the really scientific men of the city.

The appointment of amateurs and unscientific persons to positions in scientific bodies, often has ludicrous results. One Academy of Science discussed an ancient bone dredged up in salt water. It was perforated with fossæ in series, and it was concluded that it was a mouth bone of a fossil fish. It turned out to be the head of and ancient tooth-brush. An exhibition of foot-tracks on ancient rocks before the same Academy, brought to his feet a dancing master, who illustrated the formation of the impressions terpsichorean fashion.

Another plan for promoting the prosperity of scientific bodies is to have dinners and social receptions. These methods are always successful in drawing together numbers, and if persons are to be elected members of such societies in proportion to their gastronomic capacities, such a system must be eminently successful. To be serious, however, and to repeat what should be self-evident to every person, this plan tends only to an increase of non-expert membership, which is really at the bottom of all the evils which have befallen scientific societies. Hence, unless some measures to protect the membership be adopted, this method of "promotion" should be always rejected.

The result, both of our observations and cogitations on this subject is, that the only method by which Academies of Science can advance themselves in the public esteem, is to continue in their work of original research. If they cannot acquire public confidence in this way, they cannot acquire it at all. There is no short cut to this so-called "success." As in all other human endeavors to wrest advantage from Nature, labor and labor only "omnia vincit." As with the agriculturist, the machinist, or the accumulator of money, devotion to work and this only, brings the rewards which we seek. The visible products of labor are what men respect, and if the scientific man wishes to inspire the respect of wealth, he must show results, rather than bestow on men of wealth what are to them empty honors.